

16TH AIRCRAFT PRODUCTION NUMBER—JULY, 1956

# MACHINERY



## CLEARING TRANSFLEX puts automation on wheels

Just load the stack feed shown in red at right with steel blanks, push the start button and relax. Automotive wheels come out the other end of this Clearing Transflex line completely formed and touched only by the mechanical fingers of the feed bar.

The synchronously timed presses and the feed mechanism that take care of all in-

process material handling are the kind of things production men dream about, but the truly remarkable feature of this Transflex line is its amazing versatility.

Ordinarily, automated equipment is strictly a one-job system. Not so in this case. Dunlop Wheel & Rim Company will use this equipment to produce wheels for a number of different manufacturers. Next

year—if requirements change drastically—Dunlop can convert to a three press setup, add a press or two, or even use the presses independently. Here then is press automation with no threat of galloping obsolescence. It's a Clearing Transflex system. We'd like to tell you more about this method of flexible automation. Just write Clearing Machine Corporation.

## CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • Division of U.S. INDUSTRIES, INC.

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio





*Exit...*

## ONE SITTING DUCK

A message of importance to all contestants  
in the battle against high production costs

PIT A World War II plane against a modern jet fighter and what have you got? One sitting duck! Why? Not because the "prop job" got any *slower*. But because the modern supersonic jet got so much *faster*!

So it is with machine tools. The machine you bought ten years ago may still be working just as good as ever. Yet by today's standards of production speed and economy, that same machine can be *losing money* — perhaps more than a new machine would cost.

This "creeping obsolescence" can often go unnoticed—particularly on small-lot and tool room machines that are not geared directly to a fast-moving automated production line. So take a good look at the old universal Bore-Matics, Rotary Surface Grinders, Tool-Room and Plain Internals in your shop. Check their production and maintenance costs. The results may surprise you.

Your Heald sales engineer will be glad to help you evaluate these machines, fairly and squarely—to show you whether they are earning money for you, or losing it. If you find that you're *paying* for a new machine, you might as well *have* it!

**IT PAYS TO COME TO HEALD**



**THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.

**Worcester 6, Massachusetts**

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York





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MACHINERY, published monthly by  
 The Industrial Press, Emmett St., Bris-  
 toln, Conn. Executive offices, 93 Worth  
 St., New York 13, N. Y.

Subscription rates: United States and  
 Canada, one year, \$4; two years, \$7;  
 three years, \$8; foreign countries, one  
 year, \$7; two years, \$13. Single copies,  
 50 cents, except this special number,  
 which is \$1. Changes in address must  
 be received by the tenth of the month  
 to be effective for the next issue. Send  
 old as well as new address. Copyright  
 1956 by The Industrial Press.

Entered as second-class mail matter  
 May 25, 1953, at the Post Office at  
 Bristol, Conn., under the Act of March  
 3, 1879. Printed by Hildreth Press, Inc.,  
 Bristol, Conn., U.S.A.

British Address  
**MACHINERY**  
 National House, West St.  
 Brighton 1, England

French Address  
**LA MACHINE MODERNE**  
 15, Rue Bleue  
 Paris-IX<sup>e</sup>, France

**BFA**

**NBP**

# MACHINERY

VOLUME 62

JULY, 1956

NUMBER 11

The Monthly Magazine of Engineering and Production  
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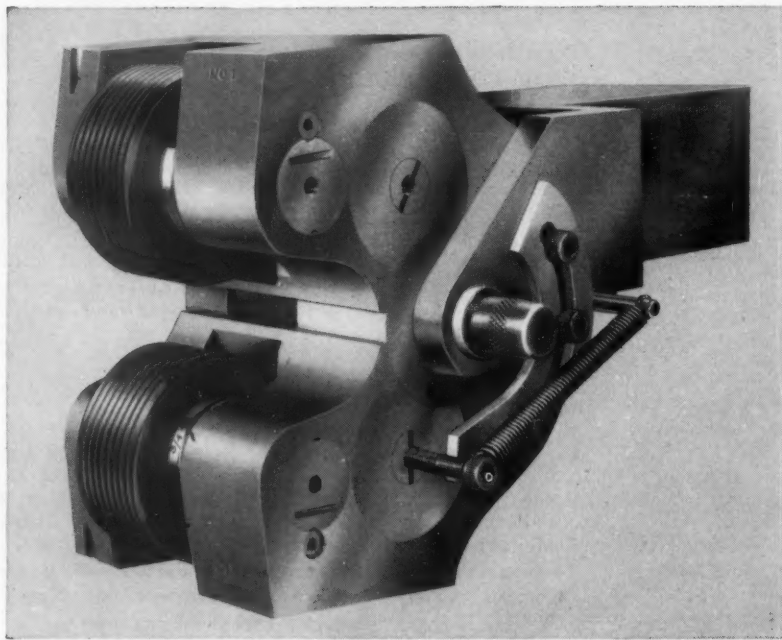
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# Coarse Pitch Threads Rolled to Class 4 Fit..



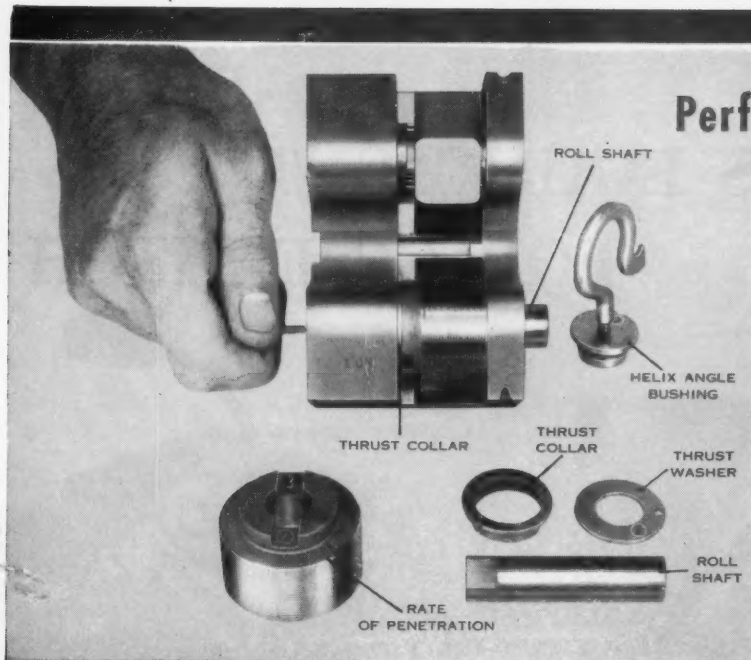
The LANROLL Thread Rolling Attachments offer features designed to ensure greater accuracy, flexibility and economy when producing threads. . . .

1. **PERFECT HELIX AGREEMENT** allows rolling coarse pitch threads to Class 4 tolerances with long roll life. Threads can also be rolled directly to a shoulder with safety.
2. **ADJUSTABLE DESIGN** provides wide range coverage for each attachment size without loss of rigidity.
3. **SUITABLE SIZES** of LANROLL Attachments have been designed for all types and sizes of automatic screw machines and turret lathes with power feed.
4. **RAPID AND PRECISE SET-UPS** are possible with special gaging methods designed for easy use and the elimination of "cut-and-try" set-ups.
5. Five sizes of Attachments roll a wide range of threads:  
 #14—#5 to  $\frac{3}{8}$ " ; #18—#5 to  $\frac{1}{2}$ " ; #20— $\frac{3}{8}$ " to 1"  
 #22— $\frac{3}{8}$ " to  $1\frac{1}{4}$ " ; #24— $\frac{3}{4}$ " to  $1\frac{3}{4}$ "

Other outstanding advantages of these LANROLL Attachments include: behind-the-shoulder threading; taper correction; and excellent thread finish and microstructure. For additional information ask for Bulletin G-96—please send specifications when writing.

**LANDIS Machine COMPANY**  
 WAYNESBORO • PENNSYLVANIA • U. S. A.

423-c

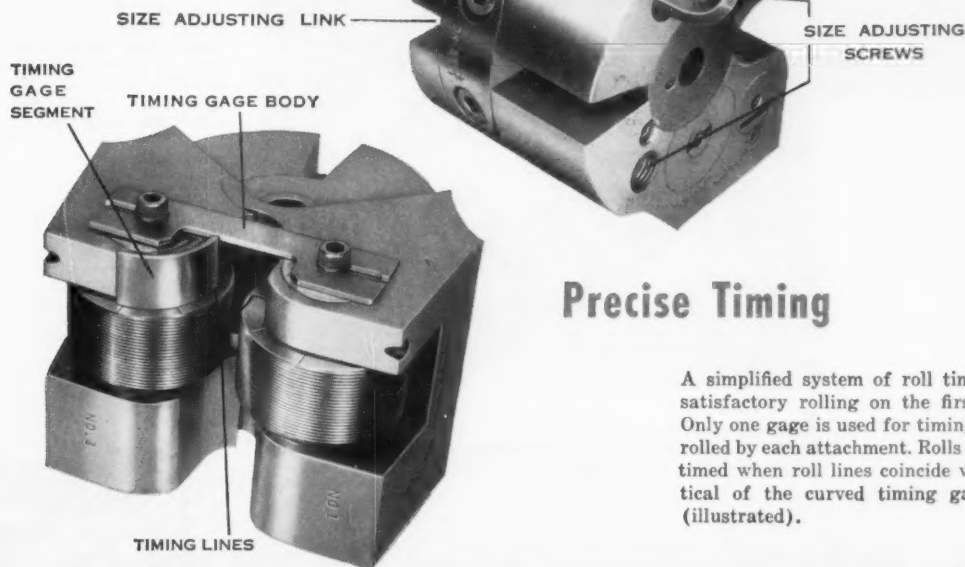


## Perfect Helix Agreement

The helix angle bushings, thrust collars, and thrust washers provide a corrective between the workpiece and roll helixes, eliminating drunkenness and ensuring coarse pitch threads to Class 4 fit. All helix angle equipment is designed and marked for rapid changes.

## Infinite Size Adjustment

Size adjustment links are used for major adjustments, with final sizing controlled by size adjusting screws. This system, and changing helix angle bushings, assures rolling all threads as though the attachment were exclusively engineered for that particular work.



## Precise Timing

A simplified system of roll timing ensures satisfactory rolling on the first operation. Only one gage is used for timing all threads rolled by each attachment. Rolls are correctly timed when roll lines coincide with the vertical of the curved timing gage segment (illustrated).

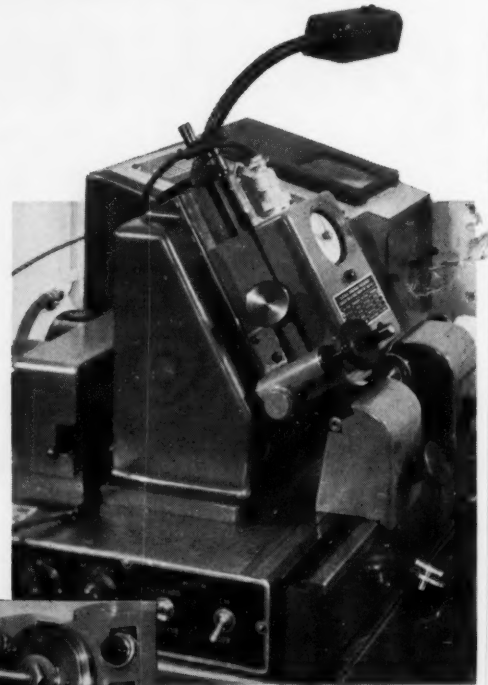
# FELLOWS EQUIPMENT FOR FINE-PITCH



**1.** Gears for a major instrument maker: Fellows 3" Fine-Pitch Gear Shaper turns them out at one-third previous cost, more than twice as fast: 120 finished gears per hour, compared to old rate of 55.



**2.** Extra precision: Fellows No. 4 Fine-Pitch Gear Shaving Machine makes good gears better with finer finish, minimum backlash, tighter tolerances where desired.



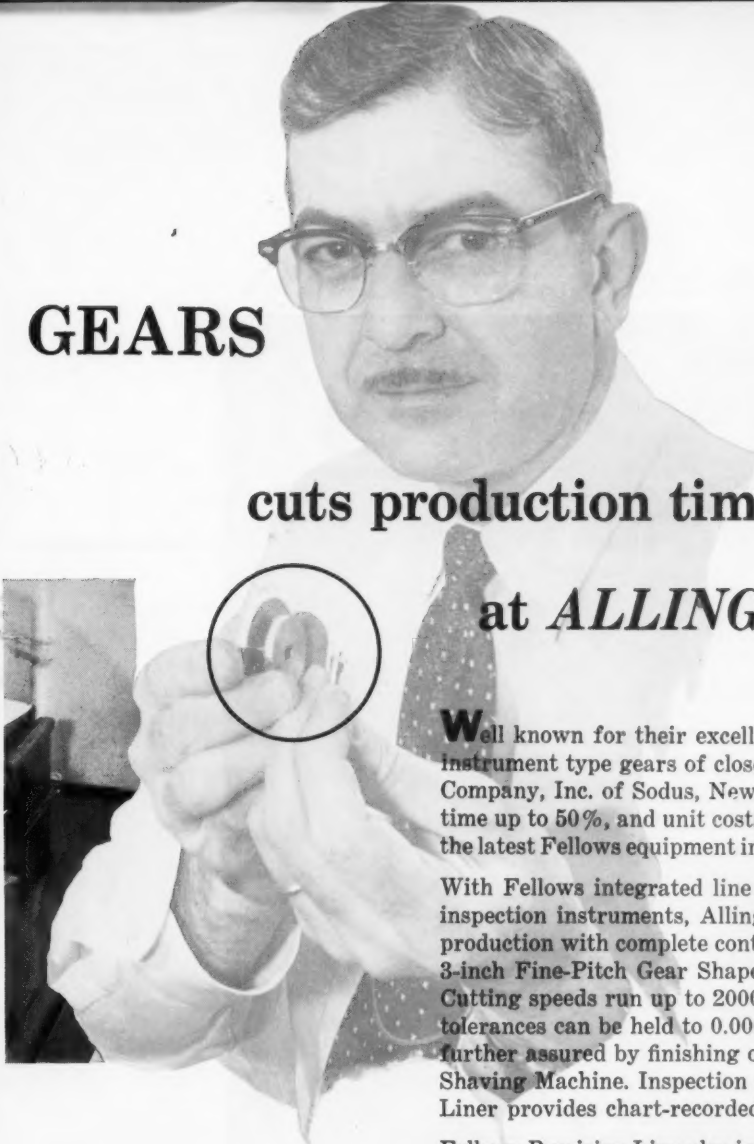
**3.** Proof: Fellows No. 4 Fine-Pitch Red Liner Inspection Instrument makes a permanent, graphic record of gear quality . . . quick, efficient and accurate.

**THE  
PRECISION  
LINE**



# GEARS

**cuts production time up to 50%  
at ALLING-LANDER!**



**W**ell known for their excellent service in producing instrument type gears of close tolerance, the Alling-Lander Company, Inc. of Sodus, New York has cut gear production time up to 50%, and unit costs more than half, by using the latest Fellows equipment in their fine-pitch gear department.

With Fellows integrated line of fine-pitch machines and inspection instruments, Alling-Lander gets high-speed production with complete control of gear quality. The Fellows 3-inch Fine-Pitch Gear Shaper is fast and accurate. Cutting speeds run up to 2000 strokes per minute and tolerances can be held to 0.0005". Close-limit tolerances are further assured by finishing on the No. 4 Fine-Pitch Gear Shaving Machine. Inspection on the No. 4 Fine-Pitch Red Liner provides chart-recorded proof of gear accuracy.

Fellows Precision Line also includes other types of gear inspection instruments and a number of models of Gear Shapers for cutting spur and helical gears of larger sizes. Your Fellows representative can give you information about any of them. And, ask him about the Fellows Plan for deferred payment too. Write, wire or phone any of our offices.

**THE FELLOWS GEAR SHAPER COMPANY**

78 River Street, Springfield, Vermont

Branch Offices: 319 Fisher Building, Detroit 2

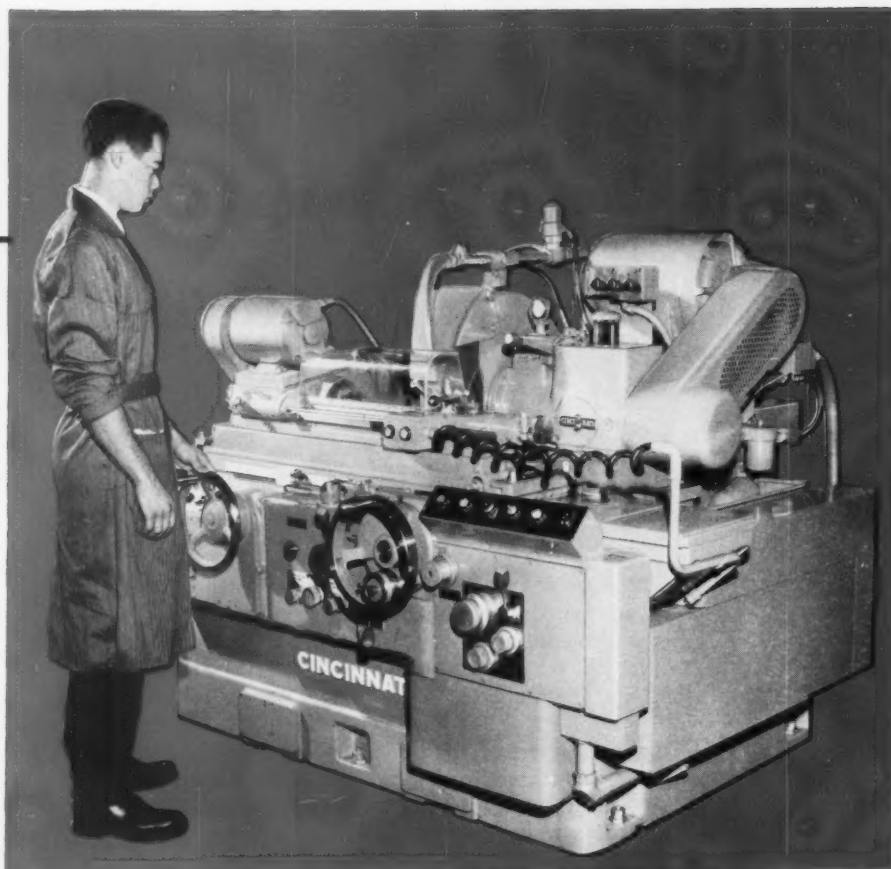
5835 West North Avenue, Chicago 39

150 W. Pleasant Avenue, Maywood, New Jersey

6214 West Manchester Avenue, Los Angeles 45

# *Fellows*

*Gear Production Equipment*



**CINCINNATI FILMATIC® 6"R x 18" Plain Hydraulic Grinding Machine** equipped with automatic push-button infeed and electric gage sizing. Members of this family group of CINCINNATI Grinders are:

Size	Between-Center Lengths	Catalog
6"R } 10"L }	18" and 30"	G-660
10"R } 14"L }	18", 36", 48" 72" and 96"	G-661



# CINCINNATI

**CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES**

# You'll get precision to the "N<sup>TH</sup>" DEGREE

...and consistently high production, too!

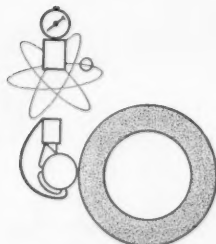
Speculation in precision and production has no place in today's metalworking shops. You can quickly end the guesswork where it hurts most . . . in your precision cylindrical work. Just install new CINCINNATI FILMATIC Plain Hydraulic Grinders in your shop and you'll have definite production that you can count on year after year, and within closer limits of accuracy than ever before. ¶ Four Cincinnati

features that help you attain these highly desirable results are illustrated below. These and many other features, translated into benefits for your shop, are outlined in two attractive catalogs: G-660 for the 6"R and 10"L machines; G-661 for the 10"R and 14"L machines. Write for copies.

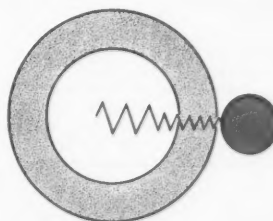
**CINCINNATI GRINDERS INCORPORATED**  
**CINCINNATI 9, OHIO**



Grinding Wheel Balancing and FILMATIC Grinding Wheel Spindle Bearings are standard equipment. (FILMATIC principle illustrated at the left.) These two cost-reducing features alone are reason enough to choose Cincinnati.



Automatic electric gage sizing (extra) includes an exclusive Cincinnati advantage . . . automatic compensation for wheel wear and truing.



Gap eliminator . . . greatly reduces time spent in "cutting air" during automatic infeed grinding operations. (extra)

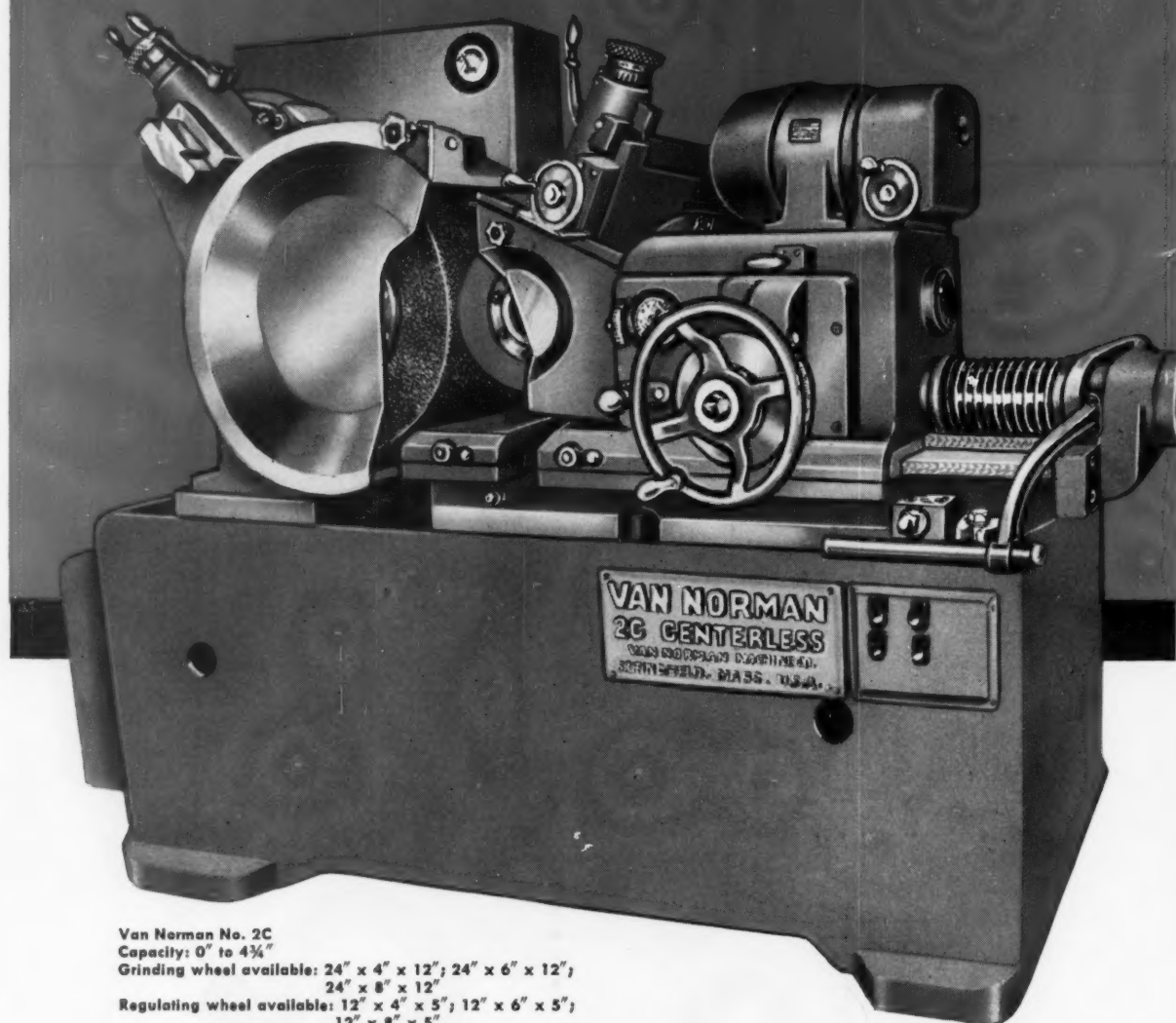
**CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES**

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—7

# Introducing The VAN NORMAN

**A Rigid, Heavy-Duty, Accurate**



Van Norman No. 2C  
Capacity: 0" to 4 3/4"  
Grinding wheel available: 24" x 4" x 12"; 24" x 6" x 12";  
24" x 8" x 12"  
Regulating wheel available: 12" x 4" x 5"; 12" x 6" x 5";  
12" x 8" x 5"  
Automatic cycling and gauging available.

*"Don't wait . . . for extra profits install a Van Norman Machine now!  
They are available on many purchase plans — Outright sale . . .  
Purchase on conditional sales contract up to 5 years\* . . . Pay as you depreciate . . .  
See your dealer or write Van Norman Company  
Conditional Sales Contracts not available to Export.*

## **VAN NORMAN MACHINE**

**MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.**



# No. 2C Centerless Grinder

## Machine with Work Capacity 0" to 4¾"

### Precision Grinds Parts Fast ... Holds Tolerances ... Cuts Grinding Costs

Newest in the expanding line of Van Norman grinders, is the No. 2C Centerless Grinder. This rugged, precision-built, heavy-duty grinder incorporates many outstanding, exclusive advantages that result in more work per operator, per work shift.

The No. 2C Centerless Grinder finish grinds many parts from solid ... or finish grinds rough-turned parts. The No. 2C gives you the facilities of three centerless grinders without change-over time ... standard grinding for throughfeed work, standard grinding for infeed jobs, and equipped with crush dressing attachment, it form grinds and does profile work.

Phone, wire or write for full details on the New Van Norman No. 2C Centerless Grinder, today.



### Outstanding Advantages

Hard chrome plating of regulating wheel slide after hand scraping, preserves original factory built-in accuracy.

Grinding wheel spindle is of a unit type construction ... totally enclosed with double-row super-precision bearings, sealed and lubricated for life, assuring chatterless troublefree operation.

Spindle requires no warm-up period, eliminating "creep" which has always been a problem in grinding operations.

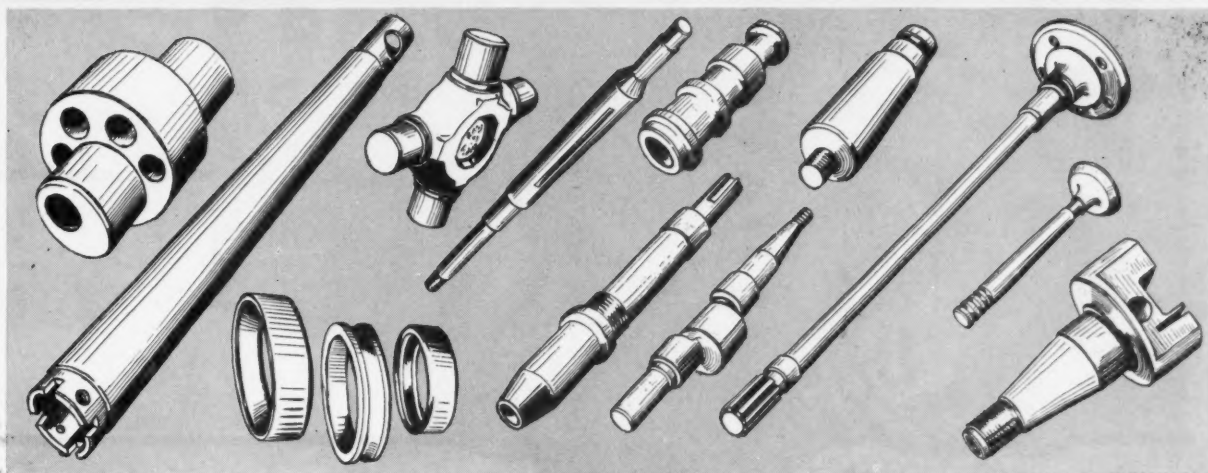
Infinitely variable regulating wheel drive.

Totally enclosed fan cooled, dynamically balanced 15HP main drive.

Independent hydraulic wheel truing devices for each wheel.

Fine hand wheel adjustment on diameter of work piece.

### Grind Parts Like These Accurately, More Economically



# COMPANY

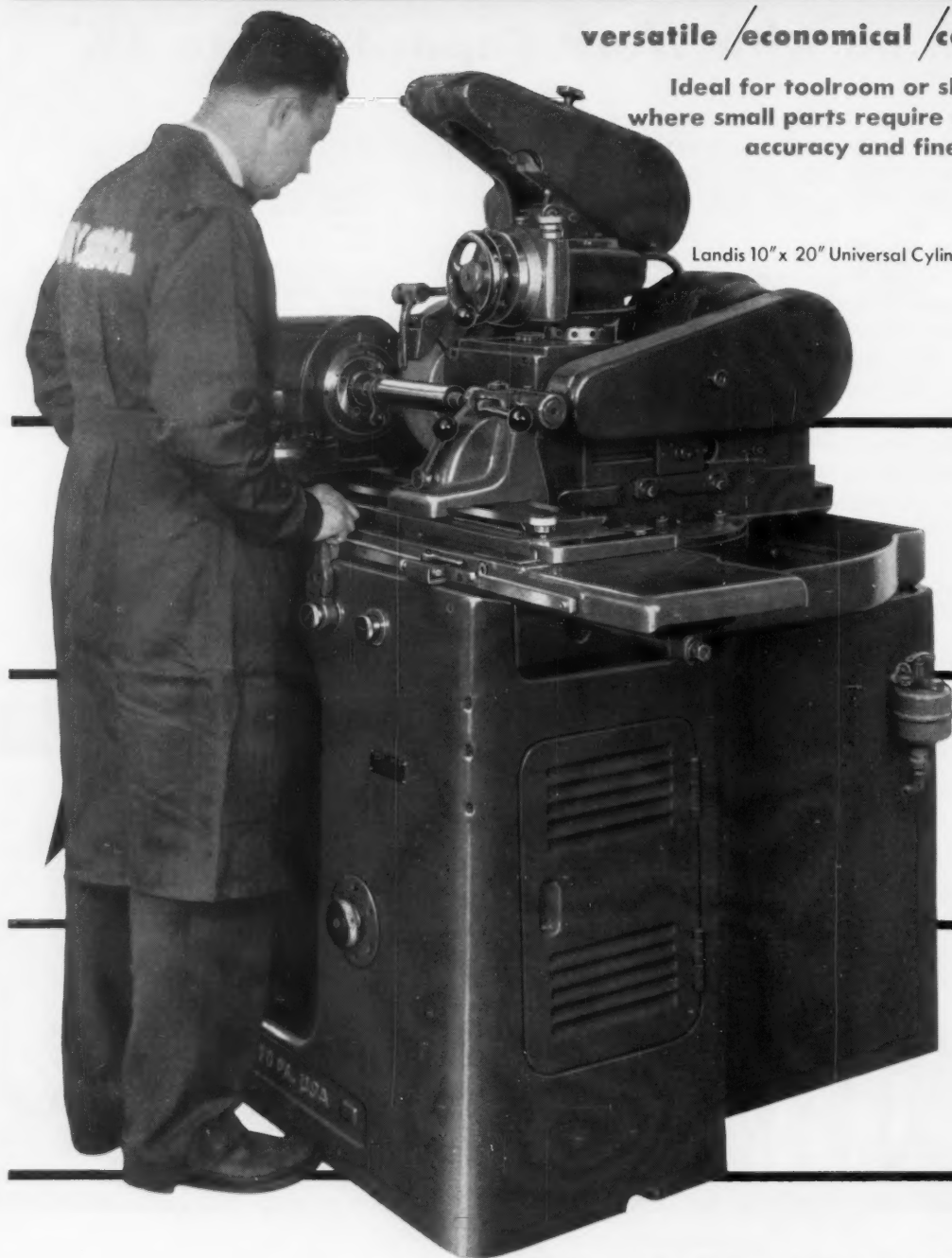
**SPRINGFIELD 7,  
MASSACHUSETTS**

# Savings in setup and operating time

versatile / economical / compact

Ideal for toolroom or short runs  
where small parts require precision  
accuracy and fine finishes

Landis 10" x 20" Universal Cylindrical Grinder



# LANDIS

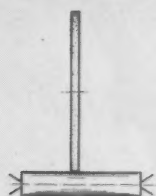
precision grinders

# lower grinding costs on small parts

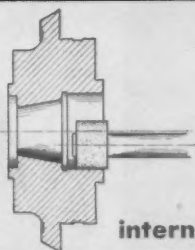
## condensed specifications

Maximum work swing. . . . . 10 $\frac{3}{4}$ "  
 Length between centers. . . . . 20"  
 Diam. standard grinding wheel. . . . . 10"  
 Wheel drive motor . . . . . 1 hp.  
 Work speed range . . . . . 90 to 600 r.p.m.  
 Net weight, including elec. equip. . . . . 4100 lbs.

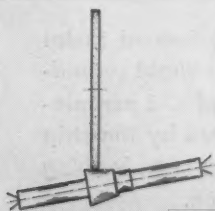
## grinding operations on the 10" x 20" universal



traverse



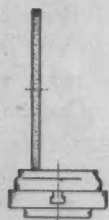
internal



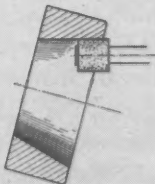
taper



angle



face



internal taper



Eye level wheel feed for fast setup and operation



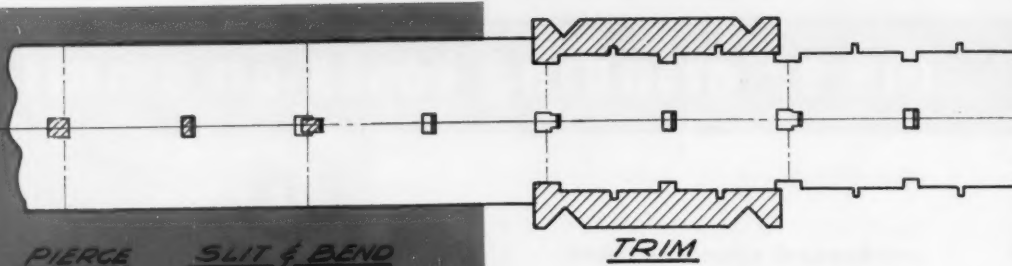
Internal grinding with modern swing-back fixture



Controls grouped for easy setup and operation.

LANDIS TOOL COMPANY

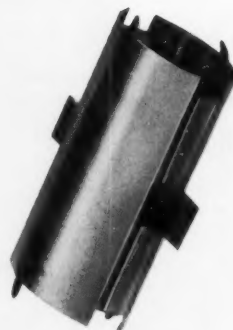
WAYNESBORO, PENNSYLVANIA



## NO SECONDARY OPERATIONS!

Stamping with folded lock seam  
produced complete on the

## U.S. MULTI-SLIDE



The part illustrated above is a radio component. This formed metal stamping with folded lock seam is produced complete *without secondary handlings* on a No. 28 U. S. Multi-Slide at the rate of 175 per minute. The sequence of operations in the dies is illustrated by the strip layout at the top of the page. The operations in the four slide forming position are indicated by drawings on the opposite page.

**Eliminate Secondary Operations and Reduce Costs:** You, like all manufacturers, are interested in achieving this end result. The part illustrated is just one of many different types of formed metal stampings which can be produced complete on the U. S. Multi-Slide. If stampings are included in your production program, the U. S. Multi-Slide may be the answer to your cost reduction problems. Ask for a copy of Bulletin No. 15-M containing complete specifications for the four sizes of Multi-Slides we now build.

# U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

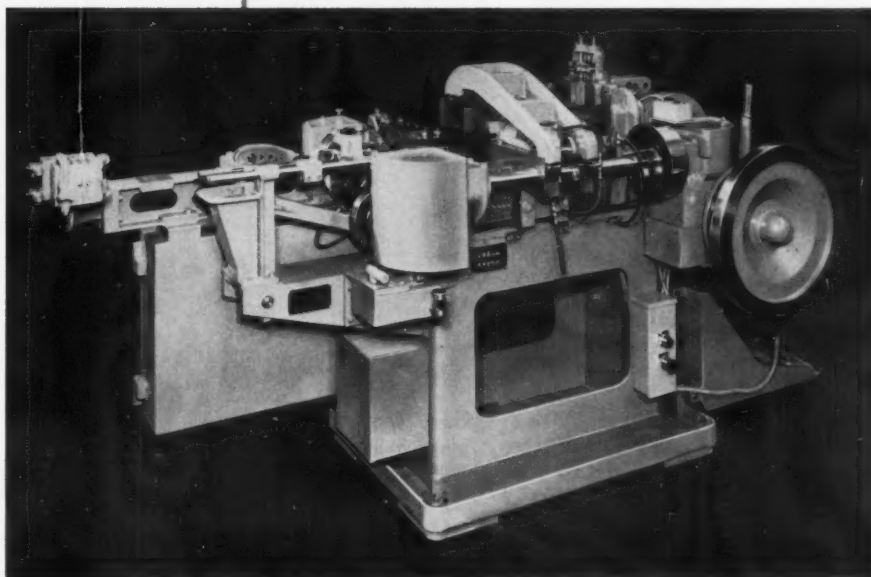
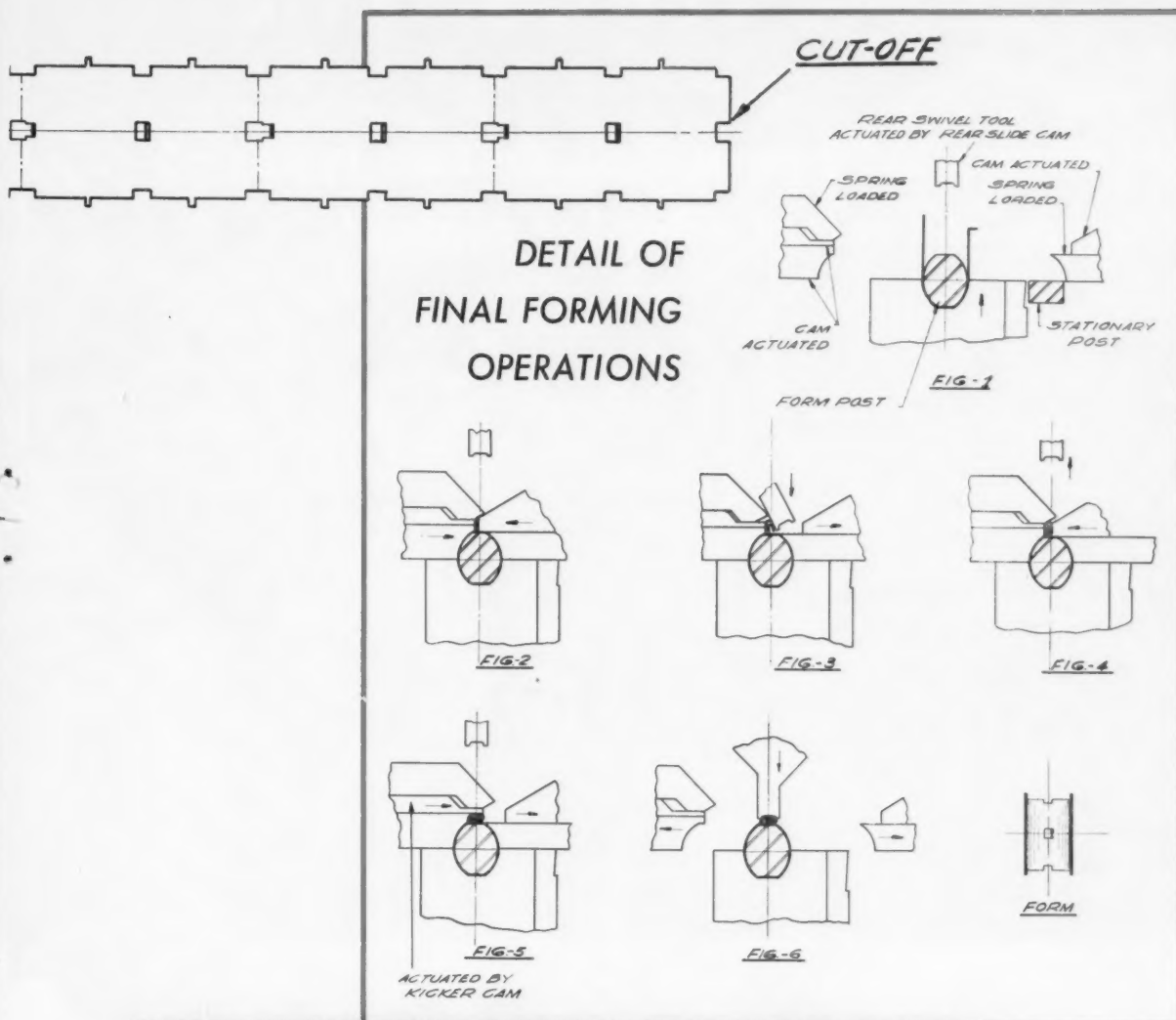
Builders of U. S. Multi-Slides

U. S. Multi-Millers

U. S. Automatic Press Room Equipment

U. S. Die Sets and Accessories





The No. 28 U.S. Multi-Slide, Symmetrical type, used to produce the radio component.

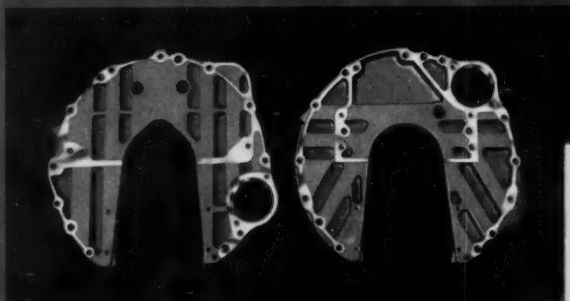
# *Buhr* **ECONOMATIC**

**performs 155 operations on two types of torque-converter adapter plates!**

**Production... 200 pieces per hour  
at 100% efficiency**

## **Operations...**

**37 drilling, 12 reaming,  
4 boring, 37 countersinking,  
36 inspection  
and 29 tapping**



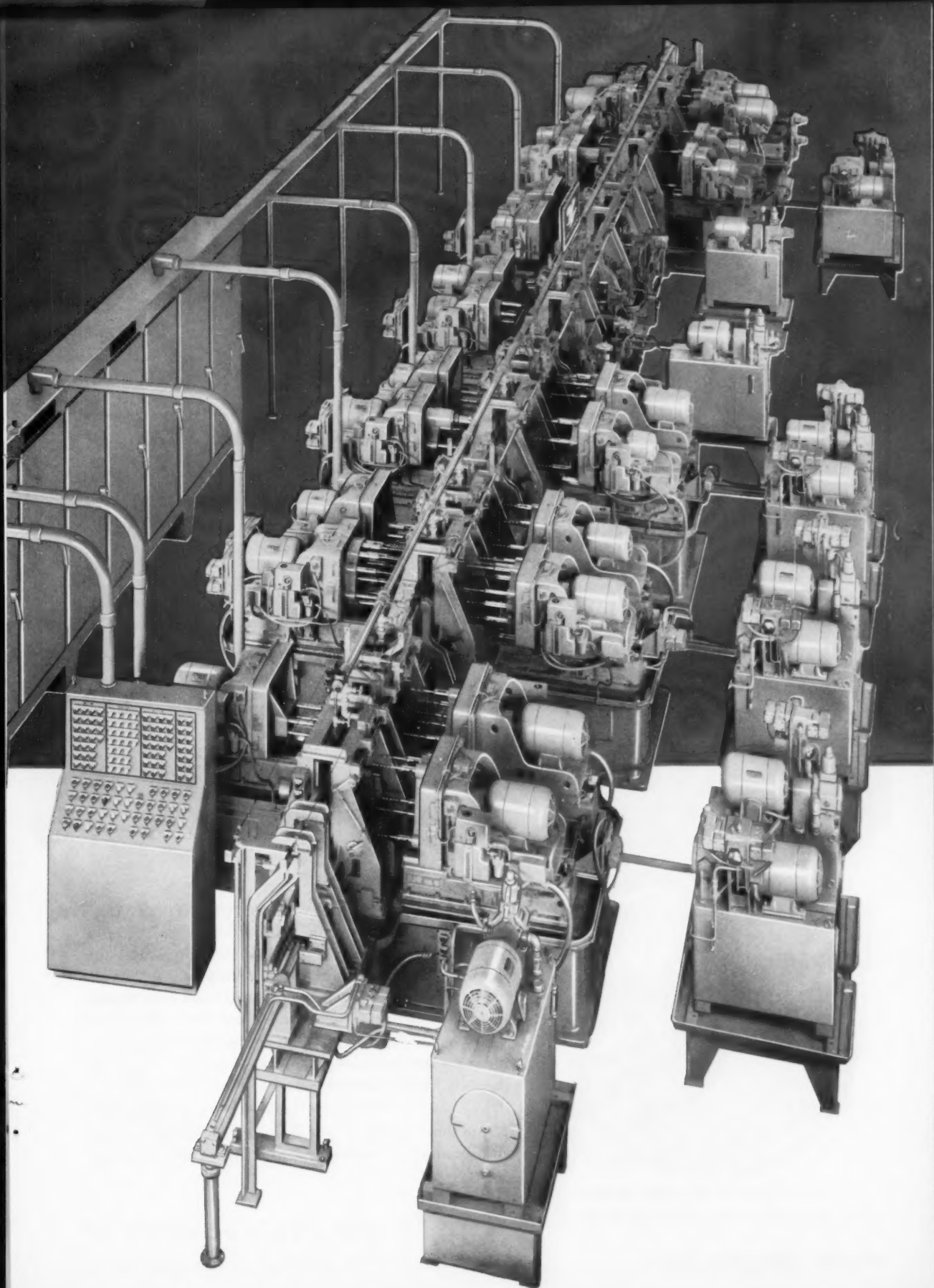
- Two types of plates may be loaded at random. Machine automatically selects and performs required operations
- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards

***Buhr***  
**MULTIPLE-SPINDLE  
HIGH PRODUCTION MACHINERY**

**BUHR MACHINE TOOL CO.®**

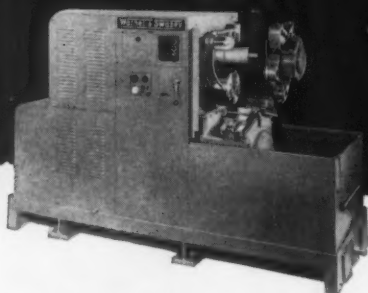
ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

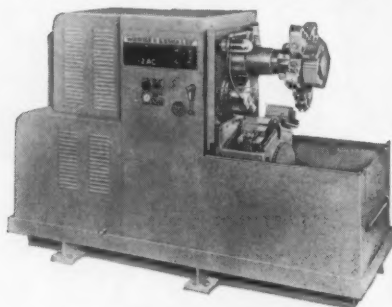


# WARNER & SWASEY AUTOMATICS

**slash machining time  
on 50 to 350 piece lots**



**1 AC CHUCKING MACHINE**  
8" or 10" Chuck — 6" Working Stroke



**2 AC CHUCKING MACHINE**  
10" or 12" Chuck — 9" Working Stroke

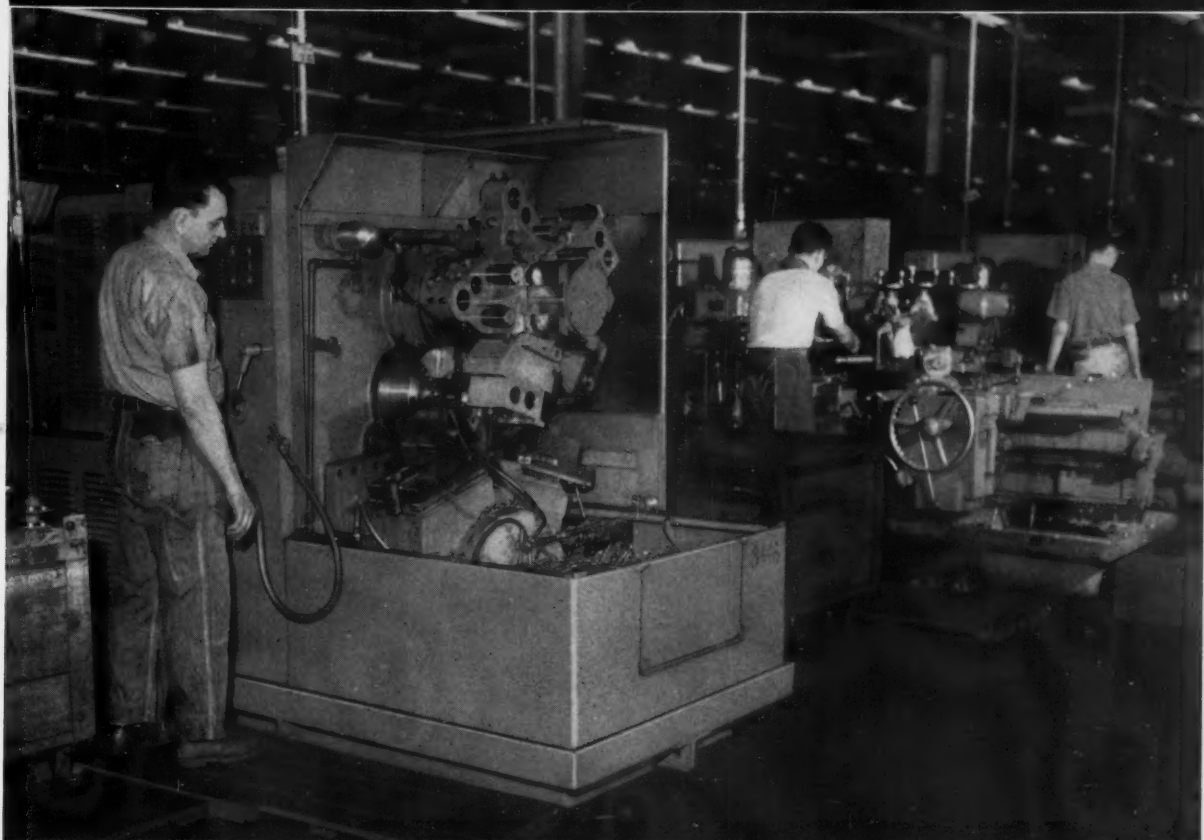
**T**HE YALE & TOWNE MANUFACTURING COMPANY, Philadelphia, machine 64,000 different parts, on a two-month cycle, for their five models of industrial lift trucks. They installed two Warner & Swasey 2 AC Single Spindle Automatics to step up production on a wide variety of small lot parts. Lot sizes range from 50 to 350 pieces.

They quickly realized the expected production increase, plus more efficient use of manpower, since one operator can easily handle both automatics.

They selected Warner & Swasey 2 AC's for the job because these machines give them the advantage of automatic production *without* the usual penalties of greatly

**YOU CAN PRODUCE IT**





increased setup time. Their setup time is just a small fraction more than on turret lathes.

"Another big advantage we had not fully anticipated," they report, "is the interchangeability of tools. The very accessible tooling area and the use of many standard turret lathe tools are valuable features of these automatics."

There are undoubtedly many small lot, "turret lathe" jobs in your own plant that could be machined faster, more profitably and with extreme accuracy on Warner & Swasey Single Spindle Automatics. Have your Warner & Swasey Field Representative show you how these machines' flexibility and fast setup can pay off for you.

**WARNER  
&  
SWASEY**  
*Cleveland*

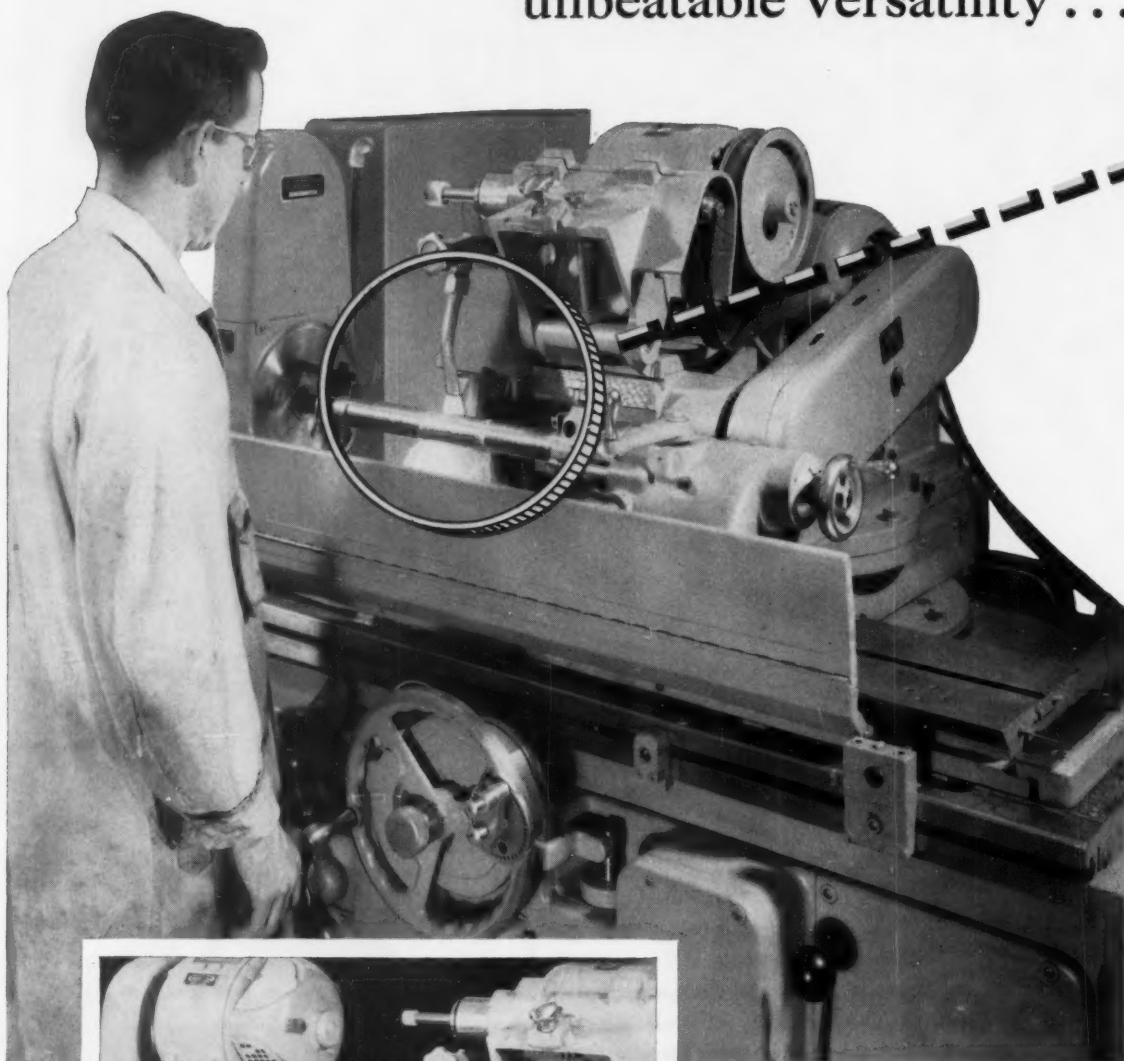
PRECISION  
MACHINERY  
SINCE 1880

**BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY**

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—17

# NEW Type U4 Norton Universal Grinders — 12"x 36" and 12"x 48" — feature unbeatable versatility . . .



*Quick, Easy Set-Ups* plus fast grinding action enable this new Norton 12" grinder to cut time and costs in a wide variety of external, internal, face and angular wheel feed grinding jobs. Here the internal grinding spindle is shown swung up and out of the way while a shaft is being ground.

*Permanent Chuck Mounting* is an outstanding advantage. Headstock spindle has a dog drive plate on one end. On the other is a 5" D-1 cam lock nose, on which you can leave a chuck mounted permanently — merely swiveling headstock 180° to start chucking jobs faster.

do  
more jobs  
... save  
more \$\$\$

*Greatly simplified set-ups give  
you more time for grinding*

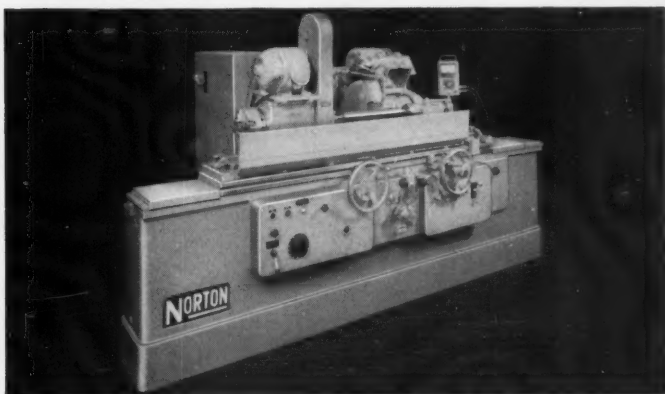
Double-barreled good news! The new Norton universal grinders are made in 12" x 36" and 12" x 48" work capacities!

Versatility keynotes the design, with feature after feature increasing the job range and cutting operating costs. For example, take the work speed range of 40 to 400 r.p.m. You get an infinite number of speeds over this wide range, simply by turning a dial.

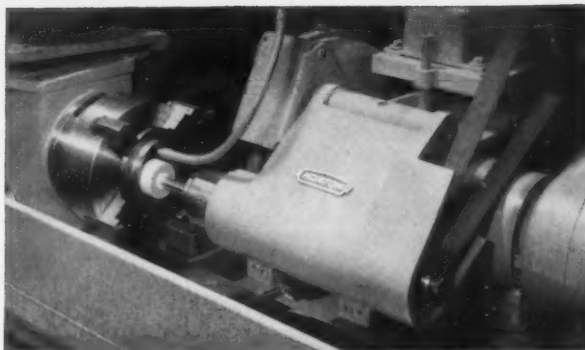
Other important features are illustrated here. It will pay you to look them over carefully — and consider their advantages in your own production.

*Get the whole story*

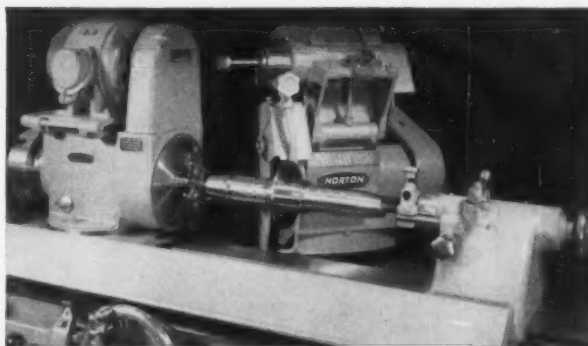
on the broad operational scope and fast, precision performance of these new Norton 12" grinders. See your Norton Representative, or write us direct. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.



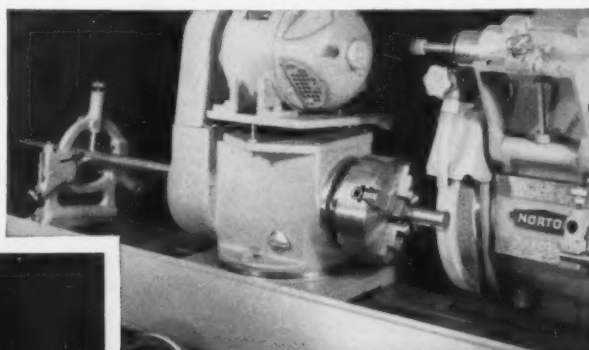
12" UNIVERSAL GRINDER — TYPE U-4. Fast grinding action for external, internal, face and angular wheelslide jobs. Permanent chuck mounting is one of many advanced features. Work lengths: 36" and 48". New SWIVELIGN Dual Electric Indicator shown measures swivel table adjustment — saves time and work. Also applicable to cylindrical grinders. Catalog 231 provides details.



For Quick Change-Over to or from internal grinding, the internal grinding spindle is permanently hinged to front of wheel slide. This also enables you to perform both internal and external grinding on a single workpiece without changing the set-up.



Settings At Any Angle are possible for both wheel and feed, independently, with this compound wheel head slide. Wheel head has swivels above and below the slide ways; upper wheel head member can be positioned to extend capacity when wheel head is swiveled.



Greater Shaft-Grinding Capacity is assured by the hollow spindle in the headstock. A 1 1/4" hole clear through the headstock spindle permits passage of shafts that may be longer than the machine — another typical advancement that means greater versatility and usefulness.

To Economize, Modernize With NEW



GRINDERS and LAPPERS

*Making better products... to make other products better*

District Sales Offices: Worcester • Hartford • New York  
Cleveland • Chicago • Detroit

America's oldest, leading shear  
*the most in accuracy, speed*



**NIAGARA**  
**POWER SQUARING SHEARS**



# builder offers you and thrifty performance

One of the greatest values of a Niagara Power Squaring Shear is the unequalled experience of its builder. Niagara has been making shears for more than three quarters of a century.

Today, as in the past, the oldest leading name in shears stands also for the most modern in shear design. Niagara has continually set the pace in offering the most of things which count the most in dependable shear performance.

## **why YOU GET THE MOST IN ACCURACY:**

- With the cutting line fully visible, the positive power actuated, self-compensating holddown grips work securely. Multiple pressure feet on 6" centers apply uniform pressure, contacting the work with low impact to safeguard material and bed against damage. Long or short work is held tight against the bed. There's no rippling of the sheet as the keen edged, low-sloped upper knife shears through . . . clean and smooth.
- Niagara's fully closed box section construction of bed, crosshead, holddown and housings plus ample and accurately held crosshead guides resist horizontal, vertical and torsional stresses with minimum deflection.
- Edges are trimmed straight and true within micrometer tolerances. Blanks, too, are cut accurately to size and shape without making compensating allowances when setting gages. Only a Niagara Shear possesses all of the necessary features to insure maximum accuracy!

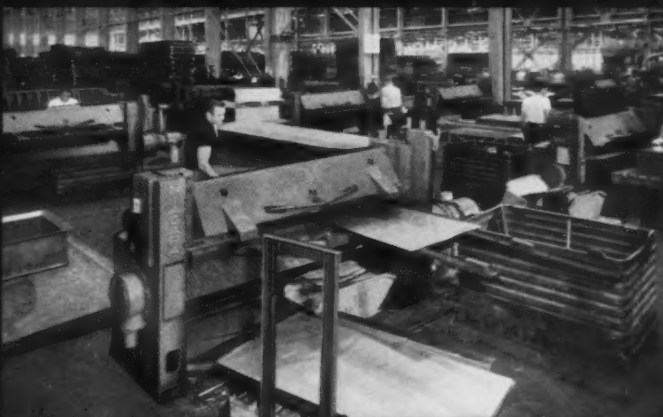
## **why YOU GET THE MOST IN SPEED:**

- More working strokes delivered per minute and instant engagement of the Niagara Sleeve Clutch assure more cuts per hour. In continuous feed shearing, quick release of the power driven holddown enables a strip to be cut at each stroke.
- There's no need to adjust knife clearance every time a different thickness of stock is cut. Individual hold-down feet are self-compensating. Two sheets of different thicknesses can be cut at the same time with the same knife adjustment and with the same accuracy.
- Ease of operation, quick setting gages and confidence inspired by safety features further increase hourly output . . . and make a Niagara Shear a truly productive, profitable investment for you!

## **why YOU GET THE MOST IN THRIFTY PERFORMANCE:**

- Simplicity of design, involving a minimum number of parts, cuts out costly maintenance. With less to go wrong, there's less to repair and replace.

- Vital parts of Niagara's driving mechanism (clutch, gearing, flywheel, eccentrics and detent) operate in enclosed oil-tight cases. Ideal lubrication and maximum safety are thus insured.
- With power transmitted from the drive through efficient spur gears and Niagara's instant engaging, multiple-point sleeve clutch, there are no sliding surfaces (such as in worm gears and friction clutches) to consume power, generate heat and wear rapidly.
- Niagara 4-cutting-edge knives, manufactured entirely within the Niagara plant, are uniformly tough to withstand hard usage and are promptly available.



Niagara Shears at work in Ohio plant of one of the major electrical appliance manufacturers.

## **MOST EXACTLY SUITED TO YOUR NEEDS, TOO!**

To fit your requirements exactly, consult a Niagara representative. With over 7 dozen models available in capacities from shim stock to 1" mild steel and in cutting lengths from 3 to 24 ft., he'll be able to recommend the shear that's right for you.

## **ILLUSTRATED, FACT-FILLED BULLETIN 69 MAILED FREE ON REQUEST**

It will give you detailed information on the complete, modern line of Niagara Underdrive Squaring Shears. Write for your copy today.



## **NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N.Y. DISTRICT OFFICES**

BUFFALO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA  
Dealers in principal U. S. cities and major foreign countries

*America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.*

# Here's the ONE outstanding wheel... for EVERY toolroom surface grinder

*The Norton G BOND-32 ALUNDUM\* combination  
is unequalled for speed, versatility and economy*





**THE FAMOUS NORTON G BOND** holds each abrasive grain just long enough for maximum cutting action, assuring a constant grinding surface of fresh, sharp cutting edges. With 32 ALUNDUM abrasive it makes a great "Touch of Gold" team for grinding high speed and alloy steels. For other applications

investigate Norton 38 ALUNDUM or 19 ALUNDUM abrasive. And remember, only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost.

The Norton G Bond is the most efficient vitrified bond ever developed for precision and semi-precision grinding. Wheels made with it bring you these valuable advantages:

*Cooler, faster cutting action . . . heavier cuts without burning . . . closer tolerances and smoother finishes . . . easier dressing and more pieces per dressing . . . more work, and more kinds of work, per wheel.*

Norton 32 ALUNDUM abrasive is another big advancement in grinding progress. It grinds exceptionally cool and fast, with minimum dressing, and is ideal for surface grinding jobs requiring fast stock removal and heavy feeds.

#### **See Your Norton Distributor**

for further facts on how the G Bond and 32 ALUNDUM abrasive add the "Touch of Gold" that saves time and money and improves product quality. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1715.

\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

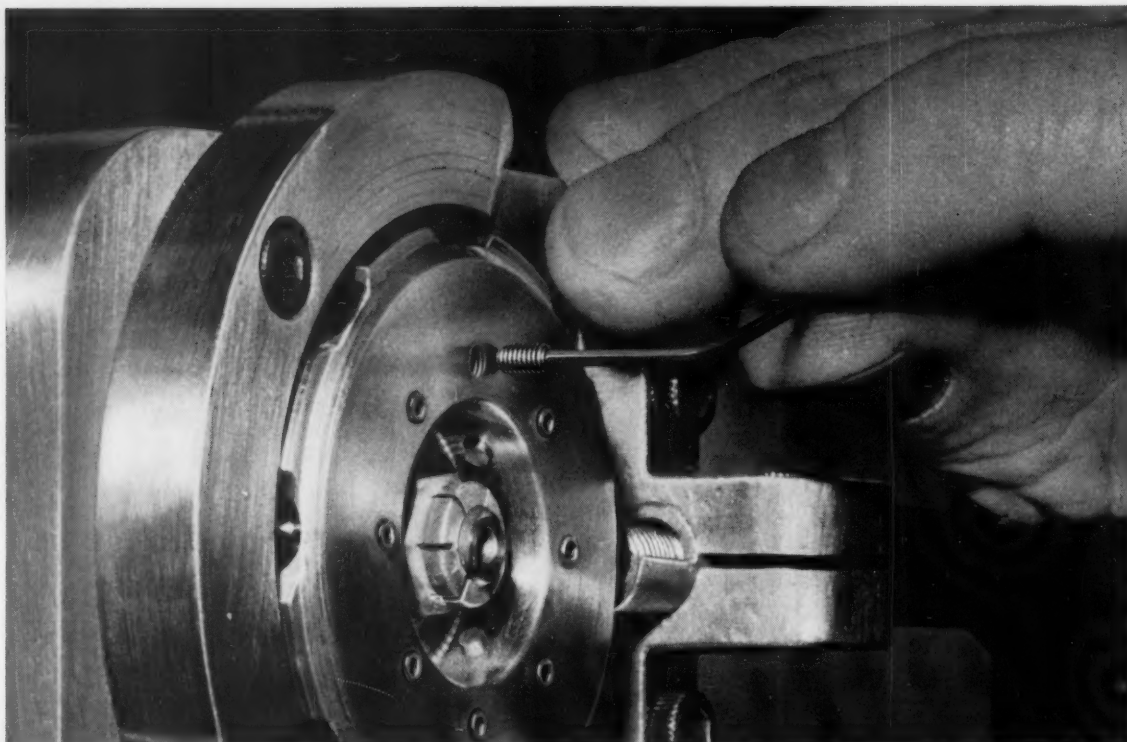
#### **Get Top Performance From These Grinders with G BOND-32 ALUNDUM Wheels**

Brown and Sharpe • Crystal Lake • Delta • Doall  
Gallmeyer and Livingston • LaSalle • Norton  
Reid • Sanford • Taft-Peirce and many others

**NORTON**  
**ABRASIVES**

*Making better products . . .  
to make your products better*

NORTON PRODUCTS: Abrasives • Grinding Wheels  
Grinding Machines • Refractories  
BEHR-MANNING PRODUCTS: Coated Abrasives  
Sharpening Stones • Behr-cat Tapes



Microsize UNBRAKO socket screws simplify design problems—even in highly specialized equipment like this prototype precision loading device for use in advanced automated production operations.

## Miniaturize with UNBRAKO set screws

### HEAT-TREATED ALLOY STEEL\* PLAIN CUP POINT Class 3 Fit Standard

Diameter	Threads per inch		L Overall Length	Recommended Installation Torque in Inch-Pounds		Weight per Box of 100 in Pounds
	NC	NF		NC	NF	
#0 D .060 F .028	..	80	1/16	..	.5	.01
	..	80	1/32	..	.5	.01
	..	80	1/8	..	.5	.01
	..	80	1/16	..	.5	.01
	..	80	1/8	..	.5	.01
	..	80	1/4	..	.5	.01
#1 D .073 F .035	..	72	1/16	..	1.5	.02
	..	72	1/32	..	1.5	.02
	..	72	1/8	..	1.5	.02
	..	72	1/16	..	1.5	.02
	..	72	1/8	..	1.5	.02
	..	72	1/4	..	1.5	.02
#2 D .086 F .035	56	..	1/16	1.5	..	.03
	56	..	1/32	1.5	..	.03
	56	..	1/8	1.5	..	.03
	56	..	1/16	1.5	..	.03
	56	..	1/8	1.5	..	.03
	56	..	1/4	1.5	..	.03
#3 D .099 F .050	48	..	1/32	5.0	..	.04
	48	..	1/8	5.0	..	.04
	48	..	1/16	5.0	..	.04
	48	..	1/8	5.0	..	.04
	48	..	1/4	5.0	..	.04
	48	..	1/2	5.0	..	.04

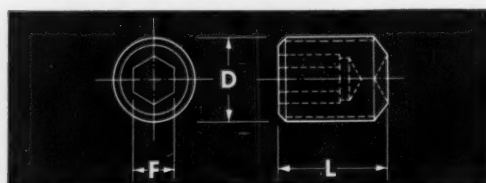
\*Also available in stainless steel



You need not design special set screws to secure your new miniaturized equipment. Microsize UNBRAKOS were developed specifically for use in modern small devices.

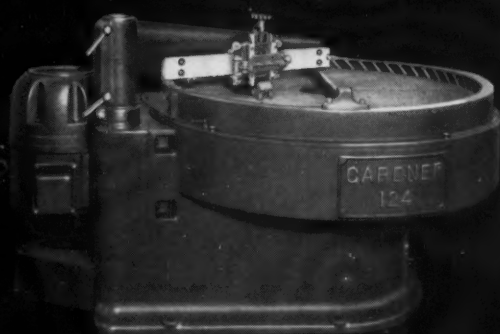
UNBRAKO screws are made of carefully selected alloy steel. They are manufactured to timepiece precision. Sockets are deep and uniform for greatest wrench engagement and longest reuse. Threads are fully formed for maximum strength and exact fit. And UNBRAKOS are heat treated to the optimum condition for high tensile strength and ductility without brittleness or decarburization.

Ask your authorized industrial distributor about microsize UNBRAKO socket screws today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

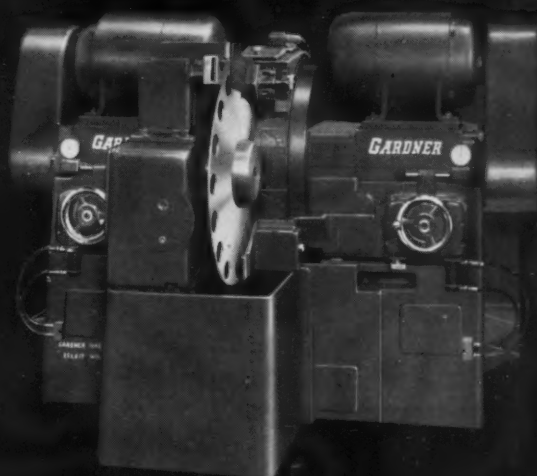


STANDARD PRESSED STEEL CO.  
**UNBRAKO** SOCKET SCREW DIVISION **SPS**  
JENKINTOWN PENNSYLVANIA





**Horizontal Disc Grinders**—For grinding one surface at a time on cast, forged or fabricated parts with either freehand or fixtured operation.



**Precision Double Spindle Grinders**—Grinds TWO parallel surfaces in ONE operation. Rotary, thrufeed or gun type work fixturing.

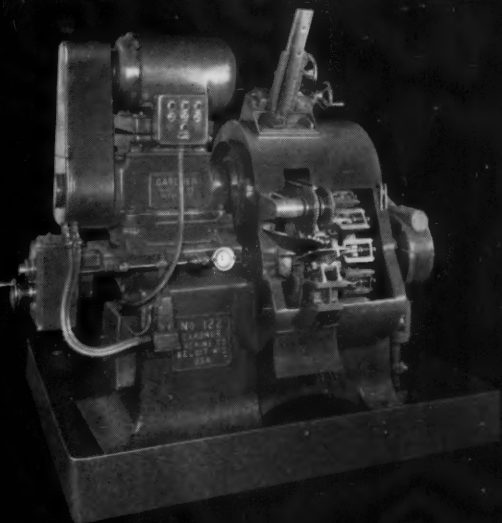
*for flat surface grinding  
... low unit cost  
... volume production*

# **GARDNER**

**precision disc grinders**

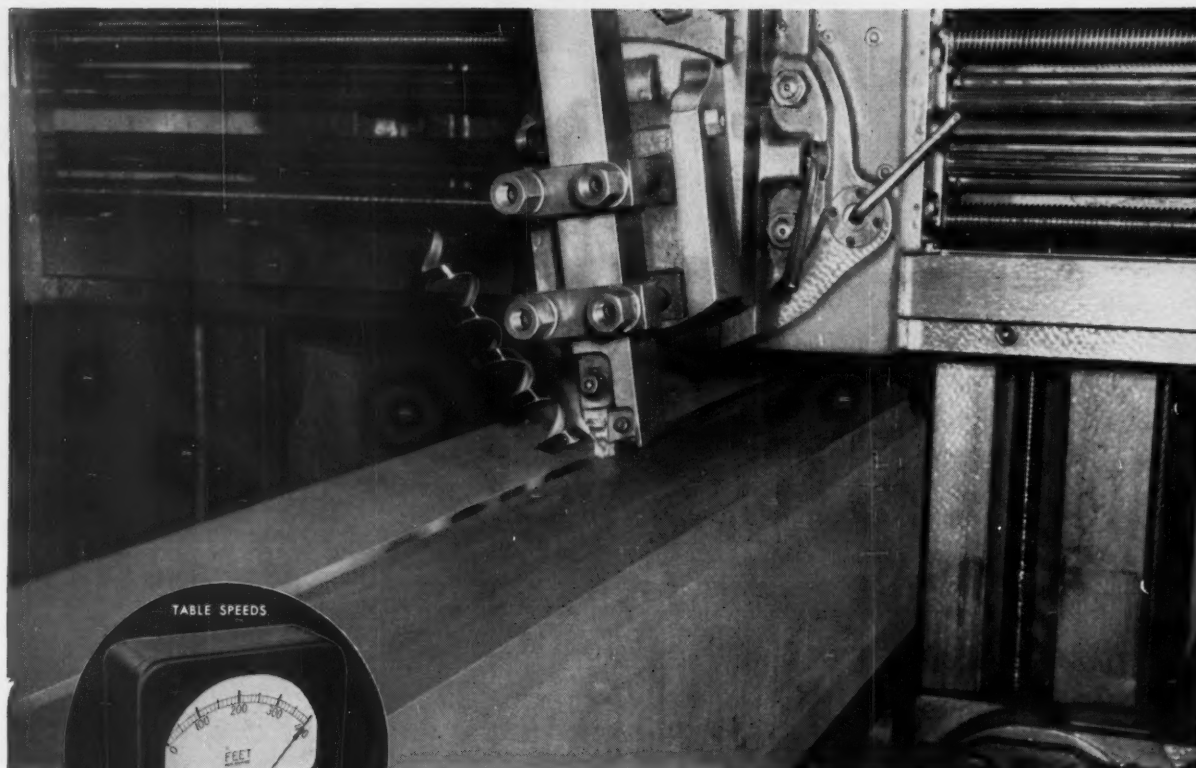
**BELOIT, WISCONSIN**

**Single Spindle Grinders**—For production grinding single surfaces. Manual and power-operated work-carrying fixtures available.



**Special Purpose Disc Grinders**—For sequence grinding, parallel surfaces, generating curved surfaces ... single or multiple surfaces in one setup.





## Plane steel or cast iron Giddings & Lewis **new** Double

**A**T tool speed of 400 feet per minute, steel or cast iron chips literally "ZIP" off the workpiece. With speeds like this, you can double present-day production with Giddings & Lewis' new Hypro Double Housing Planers.

Now for the first time anywhere, G&L Hypro advanced-design planers offer table speeds ranging from 25 to 400 feet per minute . . . permitting you to take full advantage of the greater productivity of tungsten-carbide or other high-speed cutting tools. In addition, these machines have exceptional ability to maintain precise tolerances under the most severe cutting pressures.

Outstanding features of the machine include: dual saddle and slide controls; power cross-feed to side heads; extra-heavy cross-rail; electric rail clamp; twin-helical table drive gearing; extra-high pneumatic tool lifters on both rail and side heads; hydraulic table stops and jacks,

and new design heavy box-section housings. You get 100% table support for added strength and machining accuracy, thanks to massive construction of the full double-length bed.

Giddings & Lewis adjustable voltage motor-generator set and the double-capacity table drive motor provide fast acceleration, deceleration and reversing — plus maximum power for short stroke planing operations.

For complete specifications and features, see your nearest G&L representative, or write direct to Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.

### **Literature Available:**

Ask for Bulletin No. 250 with details on new Hypro Double Housing Planers.



**G & L and HYPRO DIVISION**  
**GIDDINGS & LEWIS MACHINE TOOL CO.**

FOND DU LAC, WISCONSIN

*Builders of the world's finest heavy-duty  
Horizontal Boring, Drilling and Milling Machines  
— table, floor and planer types; Hypro Double Housing  
and Openside Planers, Planer Type Milling Machines  
and Vertical Boring Mills; and Davis Cutting Tools.*



## at 400 FPM with Housing Planers

Here's carbide planing  
of steel and cast iron at  
400 feet per minute.  
Both rail heads are equipped  
with Davis Shear Angle  
Clamped-on carbide insert  
planer tools.



# THERE'S A RIGHT GAGE FOR EVERY JOB

## Each system of gaging has its own special advantages and limitations

No one gaging system is superior to another except as it meets the certain requirements of the job. The type of gaging system you select, therefore, should be determined only after your most careful consideration.

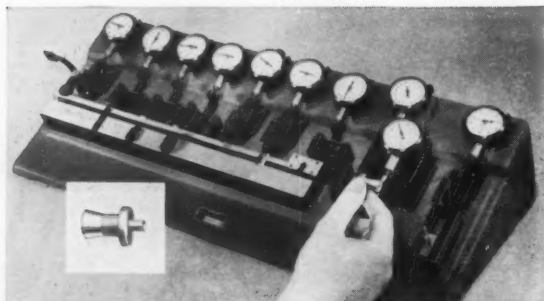
If your company is a mass producer, you need Machine Control and Automatic Sorting Gages, of course, but you also require other types of gages—each selected to suit your particular need.

Some of the gages shown here are capable of detecting dimensional variations as fine as one millionth (.000001") of an inch. But there are far more cases where it is necessary for a gage to measure only one ten-thousandth of an inch (.0001"), or even one thousandth (.001").

It is, of course, a waste of good money to buy costly gages designed for a high degree of accuracy

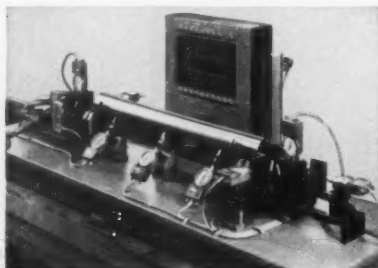
when they are to be used on everyday jobs. For instance, Dial Indicator Gages, complete with a Dial Indicator, generally cost only a fraction as much as an Air Gage and they prove entirely satisfactory in accuracy and speed for most jobs. Furthermore, with these simple gages you are not troubled with air lines and their maintenance. On the other hand, Air Gages are desirable for fast, foolproof gaging of holes, for gaging super fine surfaces, and for checking certain dimensions that are difficult to reach by other gages.

From both an economical and practical operating standpoint, it's important to select the **right** gage for your job. Since we specialize in gages utilizing all modern gaging systems and are thoroughly acquainted with gaging techniques, we can impartially recommend the right gage to do your job successfully. Call us about your requirements.



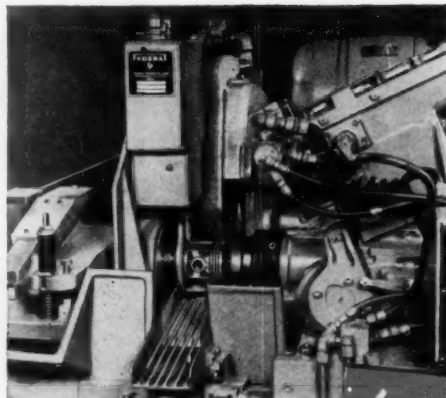
Inspecting ten dimensions on a small part

Dial Indicators are ideal . . . and inexpensive . . . on a Progressive Multi-Station Gage like this where dimensions are too close for simultaneous gaging. If conditions warranted the additional expense, an Air Gage could be substituted.



Simultaneous inspection of multiple dimensions

Dial Indicators, Electricators (Dial-Electric), or Air Gages are suitable for applications such as this. Here Electricators provide quick, accurate inspection for straightness and length. Picture panel lights clearly show any off-tolerance conditions.

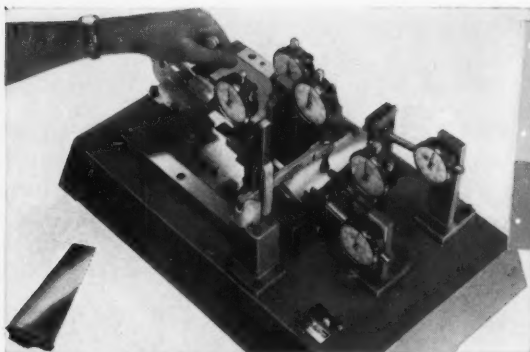


Controlling machines with gages

Machine tools, glass tube and wire covering machines, etc., can be automatically controlled to produce work which is dimensionally accurate. The grinder shown above is automatically controlled by an Electronic Gage to produce accurate cam ground pistons. Ask for Catalog.





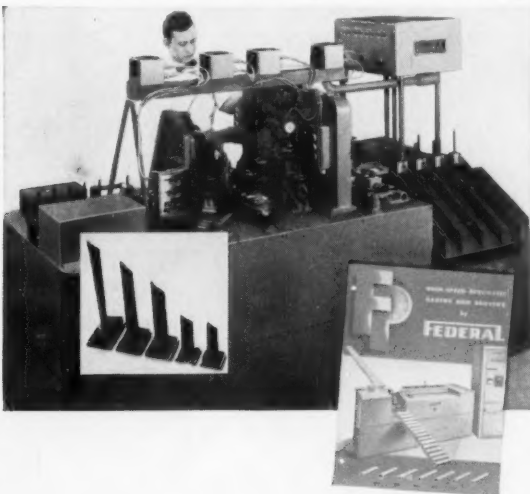


#### You will always use Dial Indicators

They are **lowest** in first and last cost. Capable of gaging up to one ten-thousandth of an inch (.0001") and sometimes to half a tenth (.00005"), they are exceedingly adaptable, fast, and simple, and the most universally used type of gage. Ask for Catalog.

#### 100% sorting, automatically

Federal uses any and all gaging systems and selects the one best suited for accuracy, speed, and convenience. Federal Gages inspect and sort workpieces into a few or many categories. They automatically gage and sort parts of all shapes and sizes, from holes .002" diameter in small  $\frac{1}{8}$ " diameter parts, to jet engine stator blades as shown here, . . . and even automobile wheels. Ask for catalog.



#### When you gage with air

Gaging with air has its own particular advantages: on some jobs Air Gages are practically foolproof. With AirProbes they can be applied to dimensions that are inaccessible by other methods. However, Air Gages are higher in price and may be more costly to maintain than Dial Indicators. Ask for Catalog.

#### Electronics for top accuracy and speed

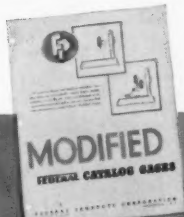


The same electronic circuit used in the Federal Master Comparator which is accurate to one millionth of an inch is used also in Federal Automatic Gages. It represents the last word in accuracy and speed.



#### Dial Indicator Gages

The Federal line of Indicator Gages is complete — includes all types: snap, hole, depth, caliper, etc., and special. Ask for Catalog.



#### Modified Gages

Federal Catalog Gages can often be modified at slight expense to meet special gaging requirements. Bring your problems to us. Ask for Catalog.

**FEDERAL'S SOLUTION  
TO THE COST OF GAGING:**  
Impartial Gage Selection  
Engineering Follow-Through  
Everything in Gages

FEDERAL PRODUCTS CORPORATION  
6117 Eddy Street • Providence 1, R. I.

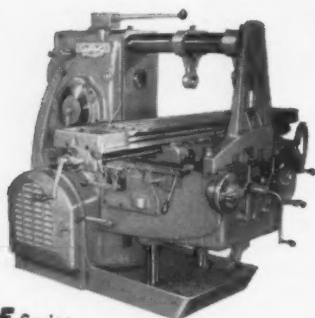
Ask **FEDERAL** First

FOR IMPARTIAL RECOMMENDATIONS ON THE RIGHT GAGE FOR THE JOB

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting or Automation Gaging

# New Kearney & Trecker's

**Controls on new TF Series milling machines are conveniently grouped up-front where they belong — to speed production ... assure accurate settings ... reduce operator fatigue**



**TF Series**  
**Model 210 Plain Milling Machine**

**POWER** — 10hp spindle drive; 3hp feed and rapid traverse drive  
**TABLE WORKING SURFACE** — 62" x 14"  
**FEEDS** — (32)  $\frac{1}{8}$  to 90 ipm  
**SPEEDS** — (24) 15 to 1500 rpm  
**WEIGHT** — 9200 lbs.

Available  
under  
Tool-Lease  
program

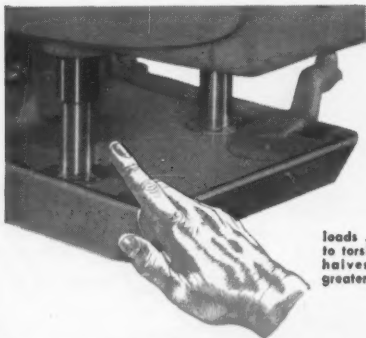
**O**NE look tells why the new TF Series milling machines — Plain, Universal and Vertical — are so easy to operate. "Bull's-eye" up-front control grouping permits operators to achieve exact settings faster, more adeptly and with greater ease than ever before. This "Fron-Trol" convenience is the key to low-cost production ... because it increases the operator's efficiency and measurably reduces fatigue through elimination of wasted steps.

The "bull's-eye" knee and saddle-mounted controls are safety-interlocked and include feed selection, directional Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, front-mounted table handwheel, saddle clamping gib and backlash eliminator, and hand and power directional controls for knee and saddle movements.

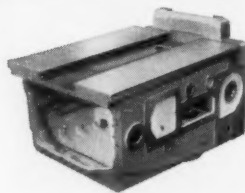
In addition, the new TF's give you a superior combination of outstanding design and operating features never before available on any other knee-type milling machines. They're built in five sizes — No. 2 to No. 6 from 10hp to 50hp.

Why take less than the latest when you want new milling machines? You can get all the facts on new TF Series machines from your Kearney & Trecker representative—call him or mail the coupon to factory today!

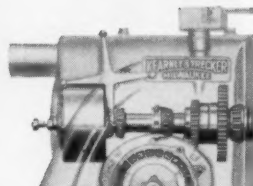
**A few more of many reasons why TF Series milling machines are so easy to operate**



**Twin Screw Knee Support** — Exclusive double-support arrangement most effectively distributes weight of the new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads ... offers greater resistance to torsional thrust under all cuts ... halves the wear factor, assuring greater, longer-lasting accuracy.



**Heavier, Wider, One-Piece Knee** — The Twin-Screw arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support ... longer-lasting accuracy.



**Three-Bearing Spindle** — Complete assembly consists of three heavy-duty bearings, flywheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.

## **KEARNEY & TRECKER CORP.**

678 W. National Avenue, Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

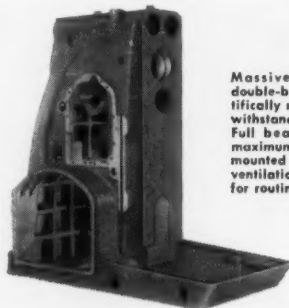
Name.....

Title.....

Company.....

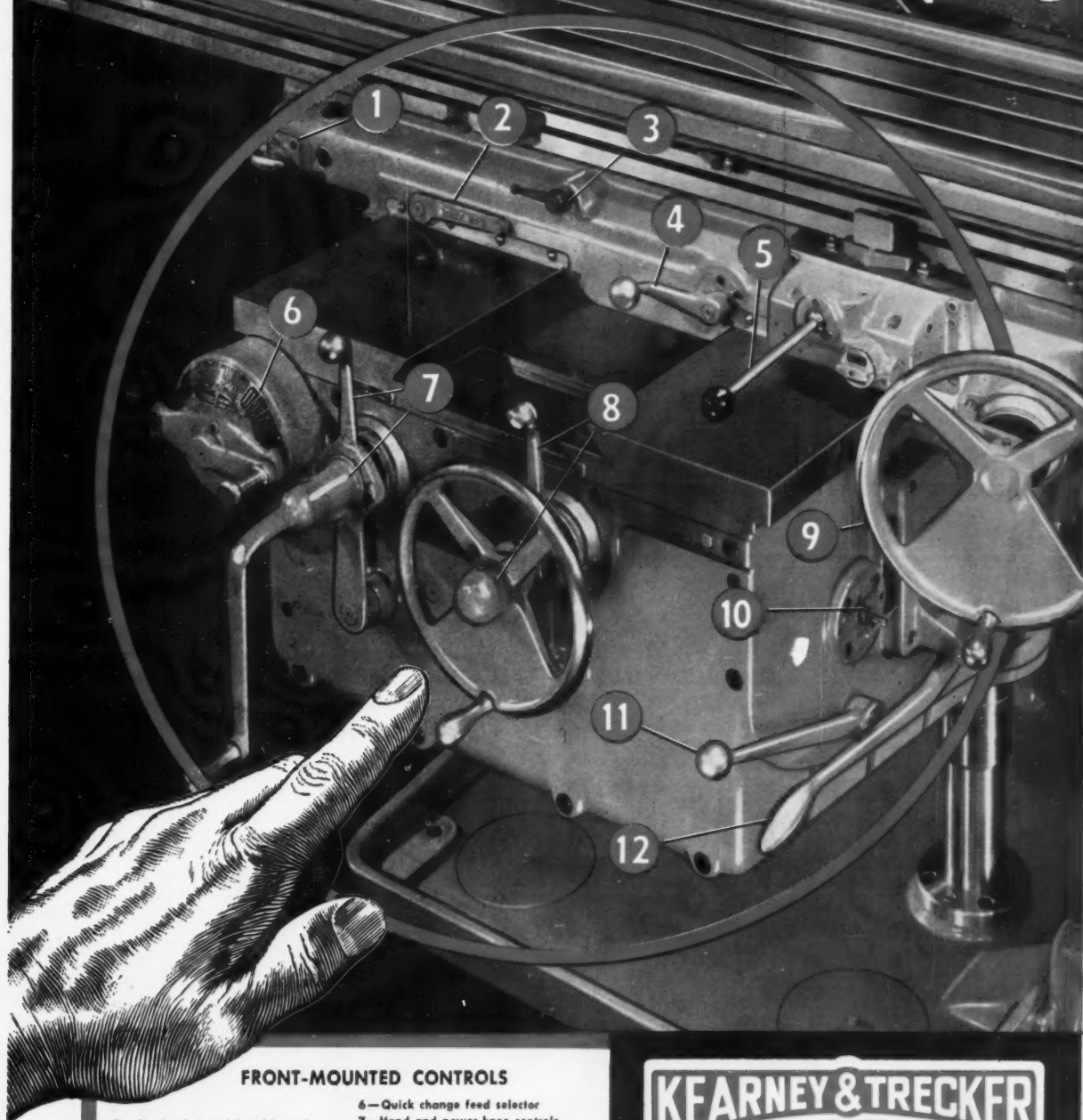
Address.....

City..... Zone..... State.....



**Massive Column** — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, and permits easy access for routine maintenance.

# "Bull's-Eye" Control Grouping



## FRONT-MOUNTED CONTROLS

- 1—Single shot saddle-table and mechanism way lubricator
- 2—Backlash eliminator
- 3—Table clamp
- 4—Adjustable saddle clamping gib
- 5—Mono-Lever and Automatic Cycle Table Control

- 6—Quick change feed selector
- 7—Hand and power knee controls
- 8—Hand and power saddle controls
- 9—Front-mounted table handwheel
- 10—Knee lubrication filter
- 11—Spindle "start-stop"
- 12—Rapid traverse control—knee, table and saddle.

**KEARNEY & TRECKER**  
**MILWAUKEE**®

BUILDERS OF PRECISION AND PRODUCTION  
MACHINE TOOLS SINCE 1898



*now you can save valuable  
one operation ahead... with*

# Carlton

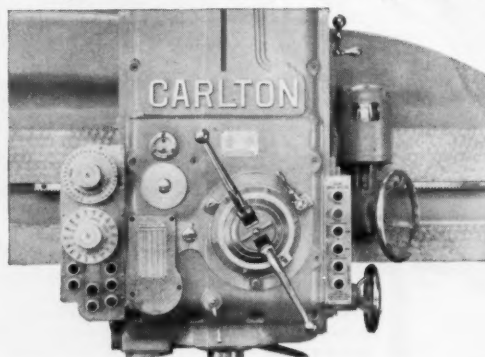
The Carlton-Leber speed-feed pre-selector system speeds up drilling by permitting operator to set speed and feed for the next operation while the machine is still under cut. With this productive new device, the time lost heretofore in setting speeds and feeds is now used for almost continuous drilling. Now you stop the spindle only for changing cutting tools.

**Pre-selector** Here's how it works: while the machine is cutting on one operation, the operator sets speed and feed dials for the next operation. When present operation is complete, he stops the

*Carlton Radial Drills now come with your choice of 3 different*



**1** *Manual gear shift:* 2 shifter levers for controlling speeds, 2 shifter levers for controlling feeds.



**2** *Pre-select gear shift:* 1 speed graduated dial and 1 feed graduated dial pre-set speeds and feeds.



*drilling time by giving operator a chance to set ingenious*

# pre-selector

spindle, changes the drill, and starts spindle again. At that instant, the gears automatically shift to the correct speed and feed.

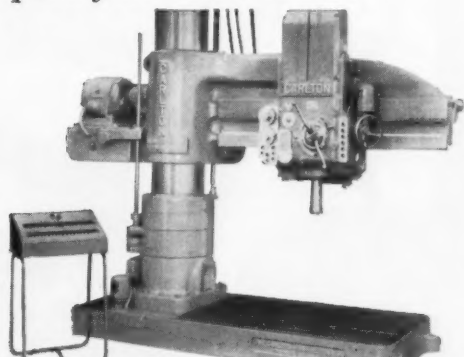
Additional time is saved by instantaneous gear shifting made possible by mechanically oscillating the change gears which assures quiet gear mesh.

**Programming** Another Carlton-Leber system—the programming unit—can be used in connection with the pre-selector. The programming system pre-selects speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

With the introduction of the Carlton-Leber pre-selector and programming systems, you can now buy Carlton radial drills with your choice of three different types of speed-feed control as illustrated below.

You can see the pre-selector and programmer in operation. Ask your Carlton distributor to arrange a showing of the new Carlton movie. Or, write us direct for descriptive free bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

*speed-feed controls . . .*



3

**Pre-selector and programming gear shift** sets up correct speeds and feeds for a complete sequence of operations.

# Carlton

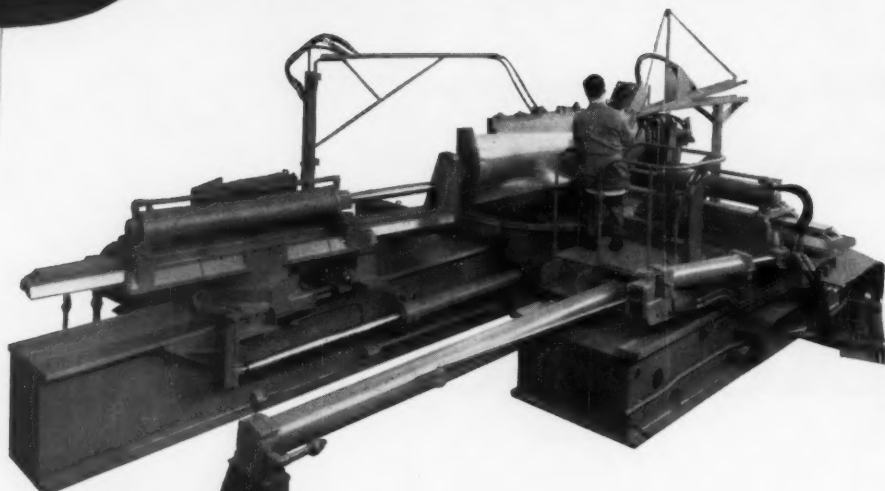
*horizontal and radial drills*



**See 'em in action!** Ask your Carlton distributor to arrange a showing of the new Carlton programming film.

# BATH

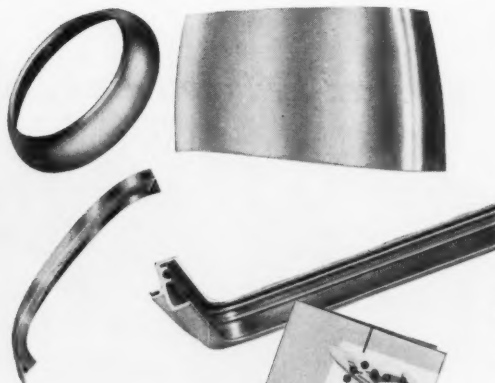
## ...RADIAL DRAW FORMERS...



The Bath Radial Draw Forming Machine combines three principle methods of forming . . . Stretch Forming . . . Compression Forming . . . and Radial Draw Forming. Parts are formed to either sweeping contours or circular shapes with complete accuracy of both cross section and contour, eliminating much benchwork. Work can be formed from bar, strip, sheets, tubes or extrusions. Stainless steel, aluminum, titanium or other ductile metals are readily formed into complex parts or components. Standard machines are available from 7 to 200 ton capacities . . . machines to special specifications in larger sizes. Send for literature covering the specifications of the Radial Draw Former. It holds the answer to modern contour forming problems.

# BATH

## ...CONTRACT FORMING...

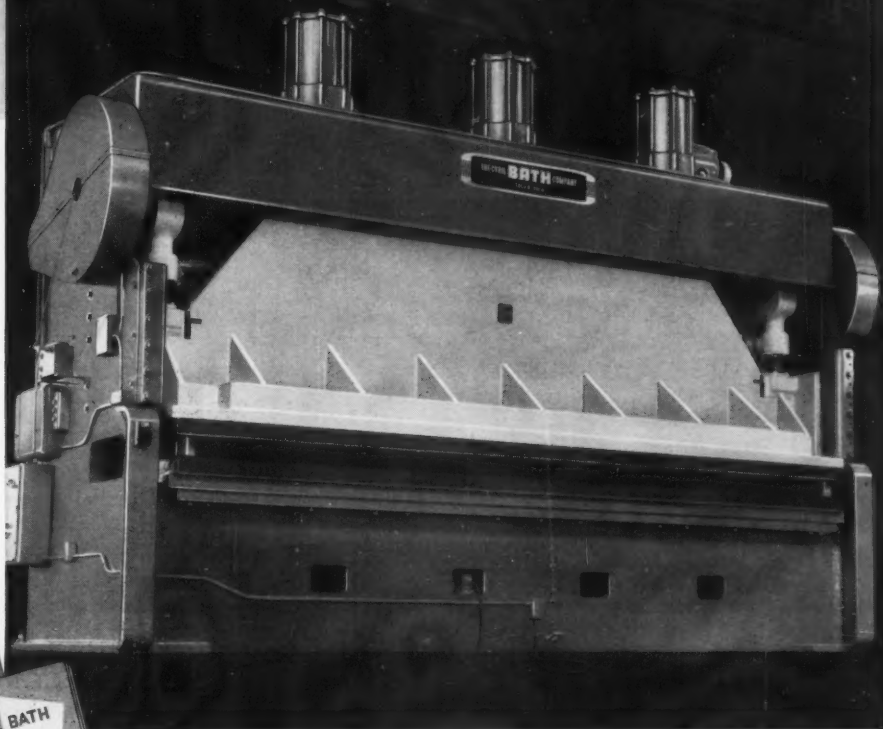


The Metal Forming Division specializes in metal curved parts to your specifications. Extensive Radial Draw Form equipment as well as more conventional forming equipment serves the needs of prime and sub-contractors in the aircraft, jet engine, guided missile and other fields. The contract forming catalog is yours for the asking . . . it covers our complete contract facilities.



# BATH

## ...PRESSES AND BRAKES...



The outstanding feature of the Bath Press Type Brake is combined versatility and high speed production with strength and rigidity. Bath Press Type Brakes have large bed and slide areas for accurate work on large panels and for progressive operation work on smaller parts. Bath Press Brakes for forming and punching work are available in 100, 120, 150 Ton models. Many of the standard features of these presses are "optional extras" on other makes. Illustrated catalogs are available.

# BATH

## ...POWER BRAKE DIES...



Many standard dies are carried in stock and are available for quick delivery. Catalog lists specials as well as standard purpose dies... plus valuable tables on tonnage requirements, bending allowances, gauge and approximate weights of sheet strip and plate materials.



THE CYRIL  
**BATH**  
COMPANY

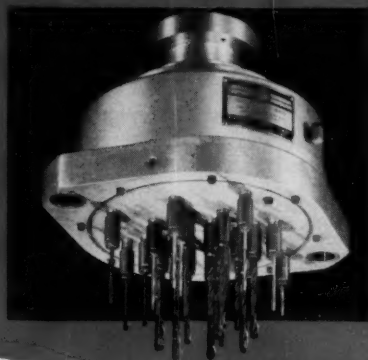
32324 AURORA ROAD • SOLON, OHIO

(LOCATED IN THE GREATER CLEVELAND AREA)

Manufacturers of Radial Draw Formers • Dies • Tools • Press  
Brakes • Tangent Bending Sequence Presses • Press Type  
Brakes • Special Machines

**MAKE ZAGAR**  
your **HOLE**  
**CENTER**

**FOR DRILLING, REAMING  
AND TAPPING . . . . .**

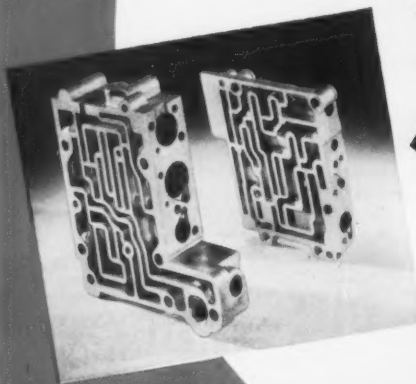


Any hole pattern —  
on any center  
up to 1 1/2" dia.

## **Zagar's Broad-Scope Engineering SOLVES ANY HOLE PROBLEM**

Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

**ZAGAR, INC., 23888 Lakeland Blvd., Cleveland 23, Ohio**

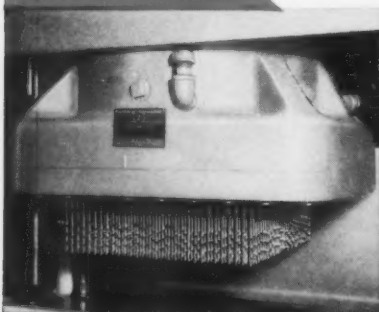


**Zagar**

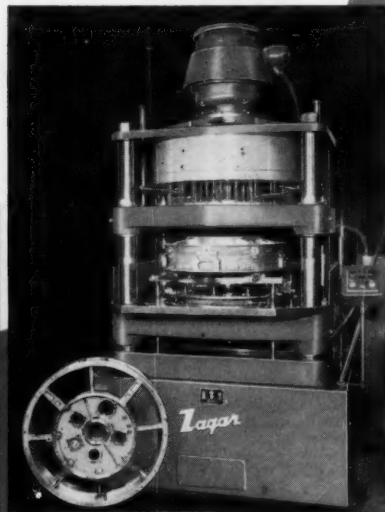
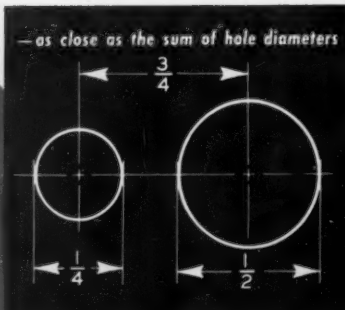
Write for Manual M-7.

**TOOLS FOR INDUSTRY and SPECIAL MACHINERY**

Any machinable  
material —  
from all angles.



Up to 1000 holes can be  
drilled **IN ONE PASS.**



**4-post ram-type drilling  
machine for aircraft parts.**



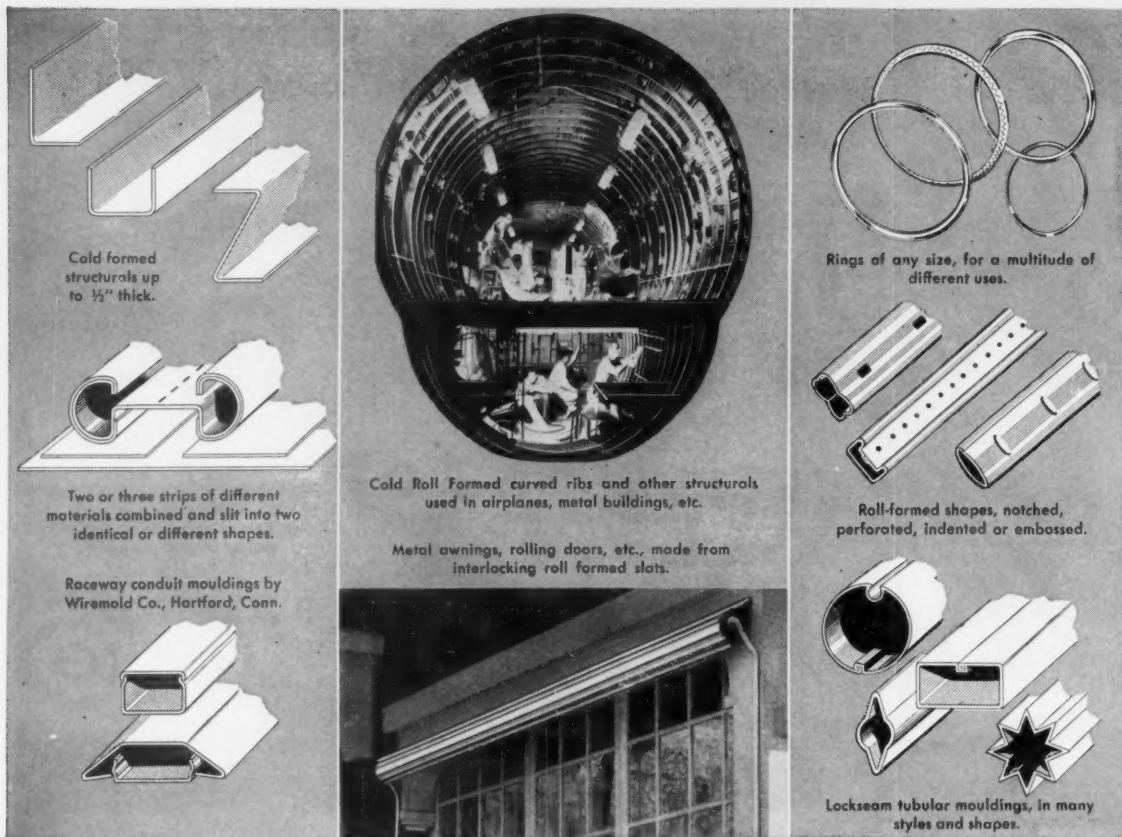


## *little* **GIANT**

The Gray planer Cub has all of the characteristics of its renowned king-size family of production giants: lightning speed-brute power-tremendous rigidity. Heavy carbide planing is effortless. Built for high production with great precision, its Gray exclusive engineering features will prove to you that

*Quality doesn't cost . . . it pays.*

The G. A. GRAY Co., Cincinnati, Ohio



## 1001 Things Now Being Done By COLD ROLL FORMING

● The basic function of a Yoder cold roll forming machine is, of course, to convert flat rolled strip or sheets at high speed into mouldings, panels, tubular, channel and other shapes.

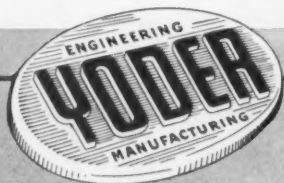
Quite often, these shapes need further elaboration before being ready for assembly or installation. They may, for instance, have to be curved, coiled or made into rings. Or they may need to be perforated at certain intervals of spacing, notched, embossed, or otherwise finished by additional operations. You may want to combine two or more materials into a finished shape, such as carbon steel with stainless, felt, wood, etc. These and many other things can be done with

Yoder machines at little or no extra cost over and above normal conversion costs, simply by providing special attachments, or by auxiliary units installed in line with the forming mill.

So, to the recognized high economy of the cold forming operation itself, other important production economies may be added. Yoder engineers are at your service in designing equipment of this kind.

The Yoder Book on Cold Roll Forming is a complete text, profusely illustrated, on the art and its scope, the machines, their tooling and application to a multiplicity of mass production needs. A copy is yours for the asking.

THE YODER COMPANY • 5504 Walworth Ave., Cleveland 2, Ohio



COLD ROLL FORMING MACHINES  
ROTARY SLITTING LINES  
PIPE AND TUBE MILLS—Electric Weld

# **GARDNER WIRE-LOKT® CONSTRUCTION**

**Assures Maximum Safety . . . Low Operating Costs**

## **FAST CUTS**

Corrugations speed the grinding of large area work or thin parts without burning.

## **FINE FINISHES**

For light stock removal smooth face discs give quality finishes and close tolerances.

## **FULL VALUE**

The entire rated thickness of the abrasive is usable.

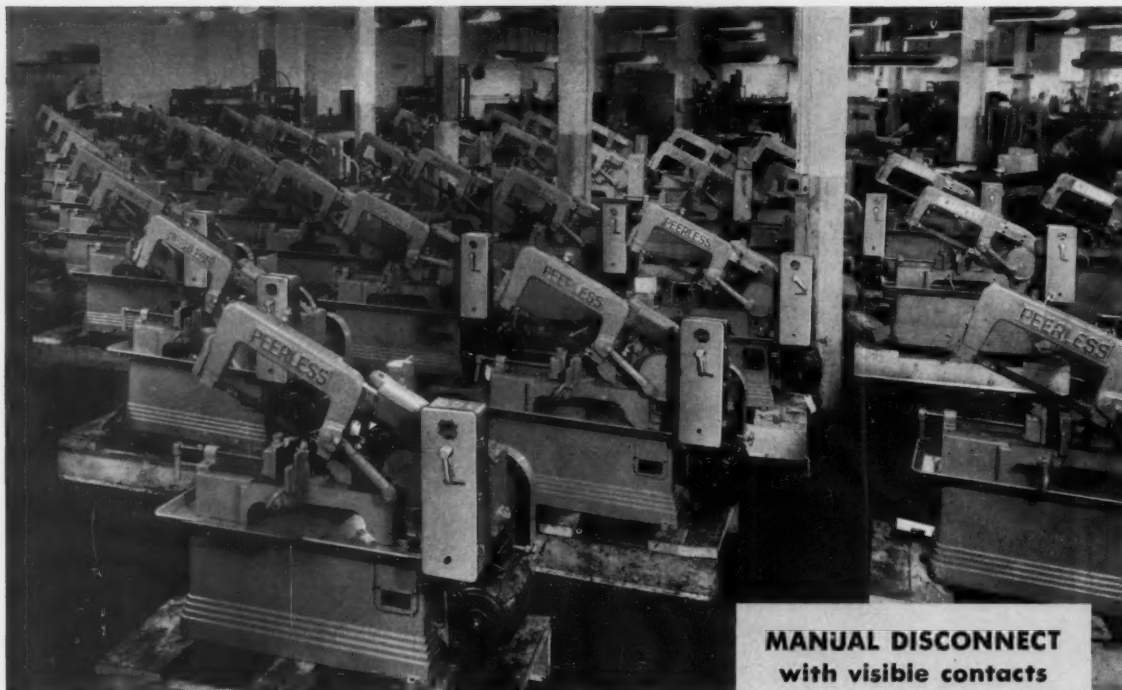
## **WIRE-LOKT® SAFETY**

Heavy steel mesh securely imbedded in the abrasive assures maximum safety.

117A  
Gardner Abrasive Specialists give you the advantages of long experience gained from making both grinding machine and abrasive discs. Individual specifications will be developed to handle your particular grinding job.

**GARDNER**  
abrasive discs  
BELOIT, WISCONSIN

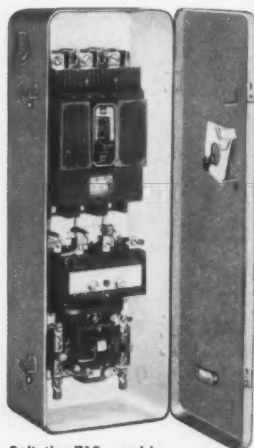




Hacksaws on shipping floor of Peerless Machine Company, Racine, Wis., all equipped with Allen-Bradley Bulletin 712 combination starters

## ALLEN-BRADLEY COMBINATION STARTERS

**Save Time • Neater Installations • Add Safety**



Bulletin 713 combination starter with I-T-E instantaneous circuit breaker.

Machinery builders like the trim appearance of Allen-Bradley combination starters on their machines. Their customers like them, too, because they provide added safety to workmen. You can't open the cabinet unless the disconnect lever is in the "OFF" position.

The new Bulletin 712 combination starters have disconnects with contacts **plainly visible** when the switch is in the "OPEN" position — another safety feature. Bulletin 713 starters use an I-T-E circuit breaker as their disconnect.

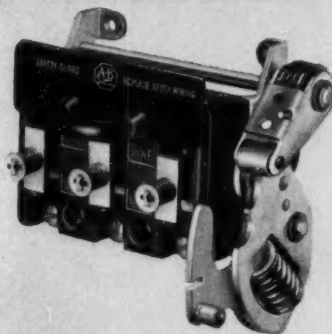
Two thermal relays give continuously reliable overload protection and prevent costly motor burnouts. After tripping they are reset from the front of the cabinet.

For complete information, send for the Allen-Bradley Handy Catalog.

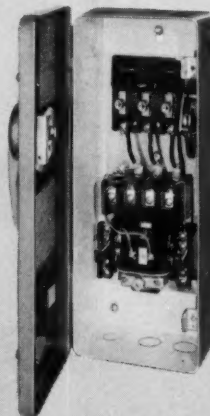
Allen-Bradley Co., 1331 S. First St., Milwaukee 4, Wis.  
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

  
**ALLEN - BRADLEY**  
 QUALITY  
**BULLETIN 712-713 COMBINATION STARTERS**

### MANUAL DISCONNECT with visible contacts



Disconnect unit (with contacts visible in the "OFF" position) used in Allen-Bradley Bulletin 712 combination starters.

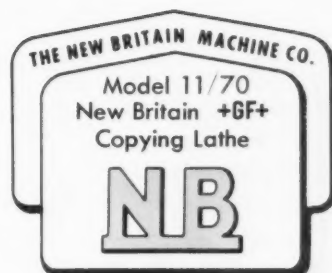


Bulletin 712 combination starter showing disconnect and magnetic starter in one enclosure.

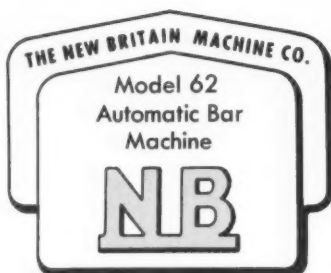


## old methods can't compete

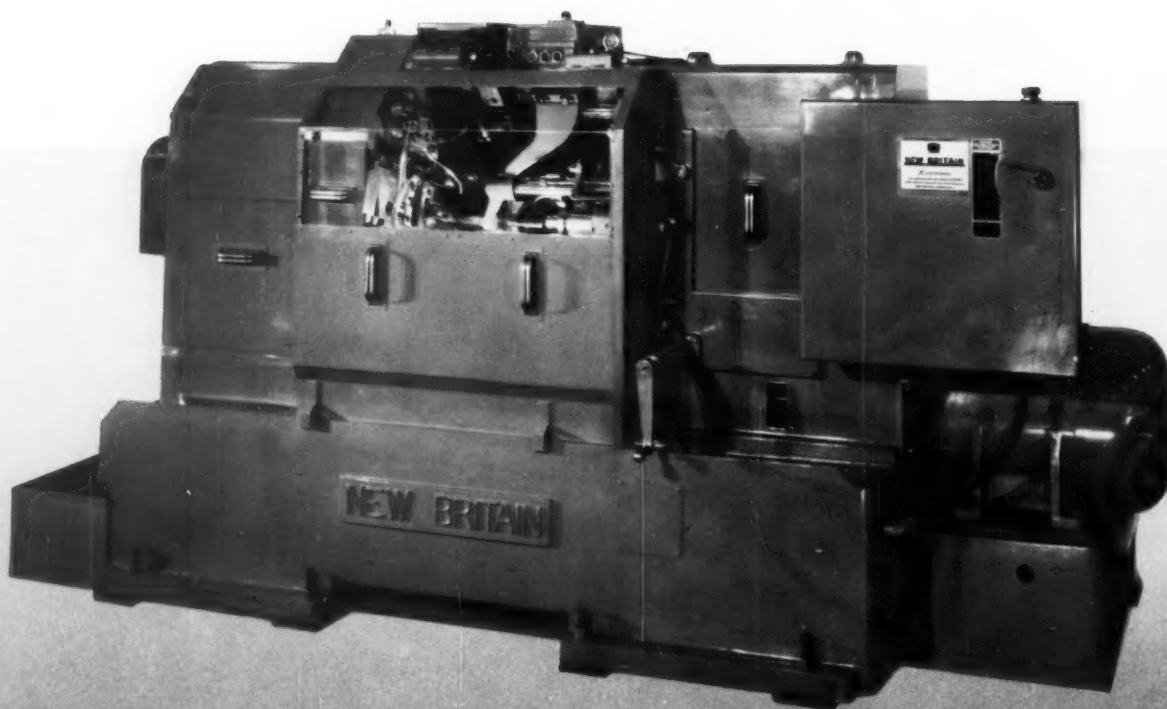
If you do *any* turning you should investigate the New Britain **+GF+** line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.



**a long new step forward  
in bar machine productivity**



Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Q.

**Why does Blanchard grind its own machine parts on a Blanchard?**



A.

**It's the only way we know to get highest quality at lowest cost!**

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

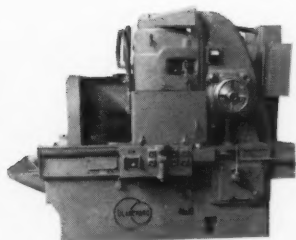
Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to **"PUT IT ON THE BLANCHARD"**.

**P. S.** You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!



**PUT IT ON THE BLANCHARD**

**THE BLANCHARD MACHINE COMPANY**

**64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

Send for free copies of  
"Work Done on the Blanchard",  
(fourth edition), and "The Art of  
Blanchard Surface Grinding".



**AUTOMOTIVE . . .** New Danly Underdrives form the car bodies of tomorrow—at lower cost for a highly competitive market.



# Danly

## presses produce more

**With Competition at an All-Time High, Successful Production Programs Are Being Built Around the Cost-Saving Advantages of Danly Presses**

There are three basic reasons why leading industries invest millions of dollars each year in Danly Presses: 1) Engineering leadership, 2) Performance, 3) Dependability.

**Engineering leadership**—In new mechanical features, in safety, in operating efficiency . . . Danly has set the engineering pace. Every Danly Press is designed to meet specific, current production needs.

**Performance**—Each press type features all of the famous

Danly advantages: extra rigid, balanced, precise construction; completely automatic oil lubrication system; cool-running clutch that lasts many times longer than conventional types; exclusive Danly control arrangements that promote operator safety and minimize accidental press damage.

**Dependability**—Danly engineering and construction pays off in more stampings over a longer period of time. Performance records in the largest shops prove that Danly Presses require less maintenance, greatly reduce need for spare parts.



**APPLIANCE . . .** Leading appliance manufacturers are meeting the production challenge with new lines of new Danly Straight Side Presses.

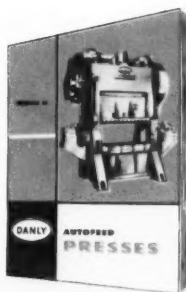


# in every industry



ELECTRICAL... New Danly Autofeeds are stamping electrical parts faster for less—with longer die life.

## ... at lower cost



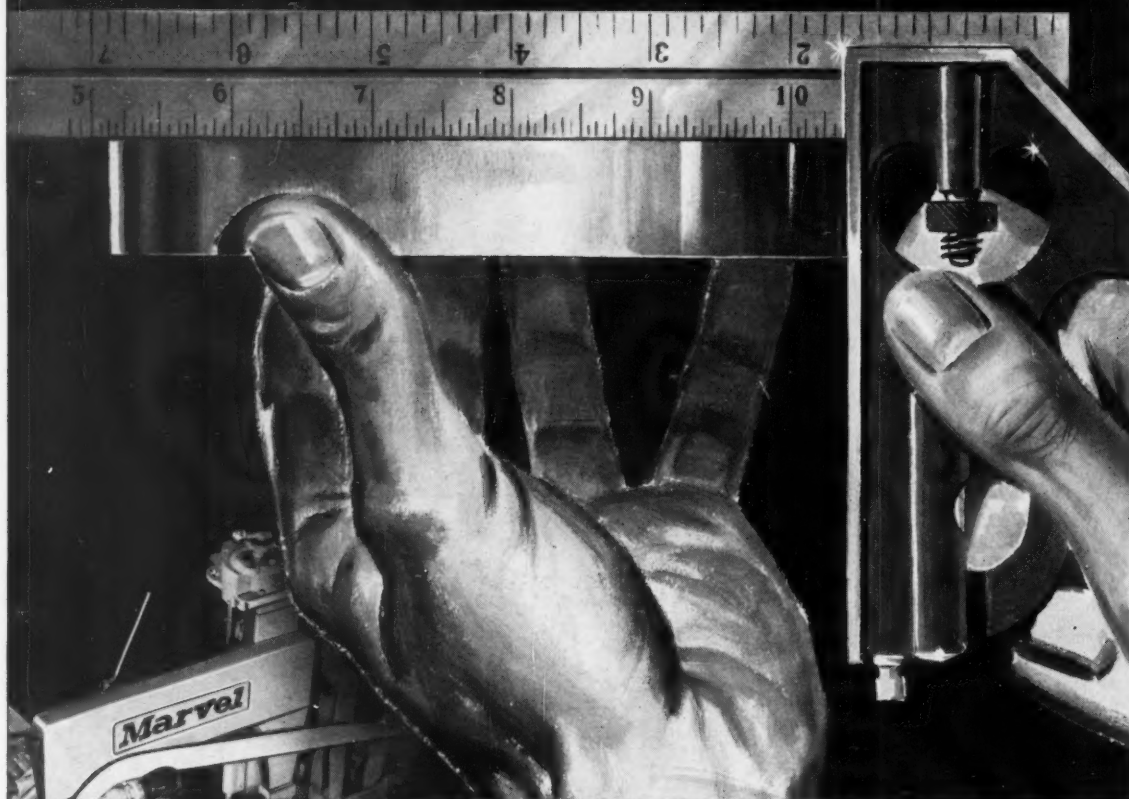
Send for these Danly Catalogs...

They Hold the Answer to Modern Mass-Production Stamping Problems

**DANLY MACHINE SPECIALTIES, INC.**  
2100 South Laramie Avenue • Chicago 50, Illinois



## IN CUTTING-OFF OPERATIONS...



### ...SPEED WITHOUT ACCURACY IS COSTLY!

Efficient cut-off of steel blanks from bars demands a combination of speed and accuracy. MARVEL, and MARVEL alone, achieves this combination with machines capable of delivering feeds and speeds which fully utilize the strength and heat resistance of the modern high speed hack saw blade.

MARVEL dual power feed and crank lever method of reciprocation are two exclusive features designed to give increased speed and efficiency. This unique dual power feed employed on the Series No. 6 and No. 9 MARVEL Ball Bearing Hack Saw Machines, simultaneously controls both positive feed depth and feed pressure, automatically adjusting both pressure and depth of feed correctly in proportion to the number of teeth in contact with the work. This automatically forces the blade to cut as deeply as possible and practical on every stroke, without demanding the attention of the operator. As a result, the work is cut-off in the fewest possible number of strokes. Quick return of the saw frame on the non-cutting stroke, accomplished by the crank lever, delivers 33 1/3% more cutting strokes per minute without increasing the blade velocity on the cutting stroke.

Accuracy is assured by the construction of the machine itself. Anti-friction ball or roller bearings are used at all load carrying points. The saw frame reciprocates on fully enclosed special design ball bearings which are factory adjusted with a pre-load, assuring permanent frictionless rigidity. Saw frame, saddle, and upright are precision machined and fitted to form a rigid integral unit capable of withstanding any cutting load with no deflection or side movement.

These exclusive features found only in MARVEL Hack Saw Machines, together with the unequalled performance of the unbreakable MARVEL High-Speed-Edge Hack Saw Blade, form a team that guarantees the fastest, most accurate cutting-off.

S-1300

There is a MARVEL field engineer near you capable of intelligently discussing your cut-off work. Send for catalog C-55, and the name and address of your nearest MARVEL field engineer.

**ARMSTRONG-BLUM MFG. CO.**

5700 WEST BLOOMINGDALE AVE. • CHICAGO 39, ILL.



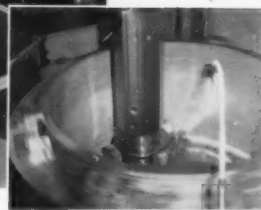
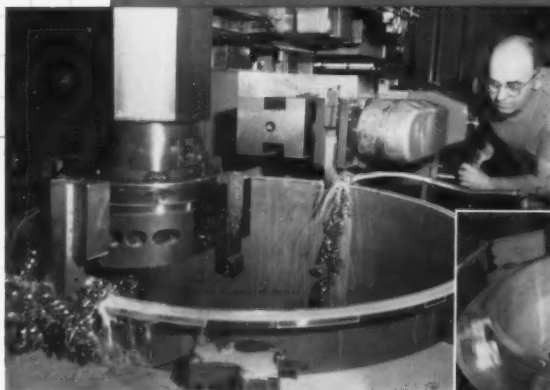
# PRODUCTION "at all time Peak"

Solar Aircraft Company of Des Moines, Iowa and San Diego, California, has found the versatility and flexibility of the Bullard Man-Au-Trol V.T.L., Model 75 a distinct advantage in the machining and fabricating of various jet aircraft engine parts and assemblies.

with

**BULLARD**

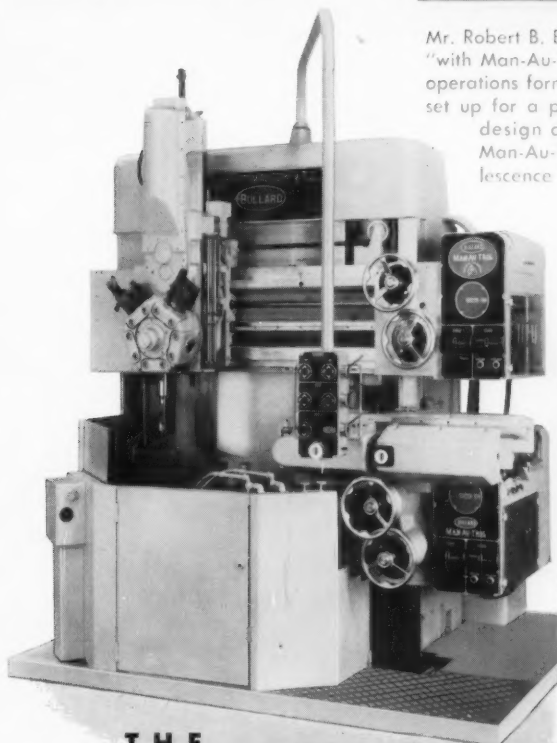
## MAN-AU-TROL VERTICAL TURRET LATHE MODEL 75



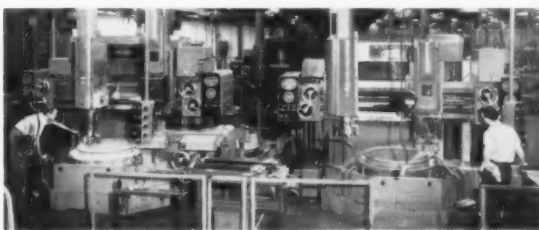
Mr. Robert B. Ballard, Production Manager at Solar-Des Moines, reports that "with Man-Au-Trol, Model 75, it is possible to do a multitude of machining operations formerly requiring numerous expensive machines which had to be set up for a particular operation, so limited in scope, that an engineering design change either obsoleted the tooling or the machine. With Man-Au-Trol, Model 75, because of its wide range of functions, this obsolescence is greatly reduced — if there is a design change, only a new set-up is made — not the purchase of a new multi-thousand dollar piece of machinery."

These same advantages can be applied to your manufacturing methods —

Ask your Bullard Sales Engineer for complete details.



**THE  
BULLARD COMPANY**  
BRIDGEPORT 9,  
CONNECTICUT



### THE BULLARD COMPANY

286 CANFIELD AVENUE • BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the

**NEW MAN-AU-TROL V.T.L., MODEL 75 CATALOG**

NAME.....

COMPANY.....

POSITION.....

ADDRESS.....

CITY.....

ZONE.....

STATE.....

# **NEW "Unionmelt" Welding Assemblies**

**for greater  
job versatility-  
performance dependability**

Versatility and dependability are yours at an all time high in an improved new line of UNIONMELT welding assemblies . . . These units embody the greatest variety of machine combinations, job applications, and design features ever offered for submerged arc welding.

Wire feed units are simply constructed and are highly efficient . . . Identical mounting dimensions for heads, brackets, and slides allow for any number of desired assembly combinations.

Welding heads have exceptional flexibility because of sturdy new mounting fixtures which provide for vertical, horizontal, and rotary adjustment. Stationary and self-propelled combinations are also available.

The wide variety of standard and custom UNIONMELT welding assemblies can easily be made to fit your particular applications—at costs lower than many current standard models.

*See your local LINDE representative today for information on the many other new features—or write for free illustrated literature.*



## **Linde Air Products Company**

**A Division of Union Carbide and Carbon Corporation**

30 East 42nd Street  New York 17, N. Y.

Offices in Other Principal Cities

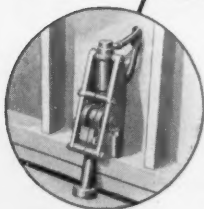
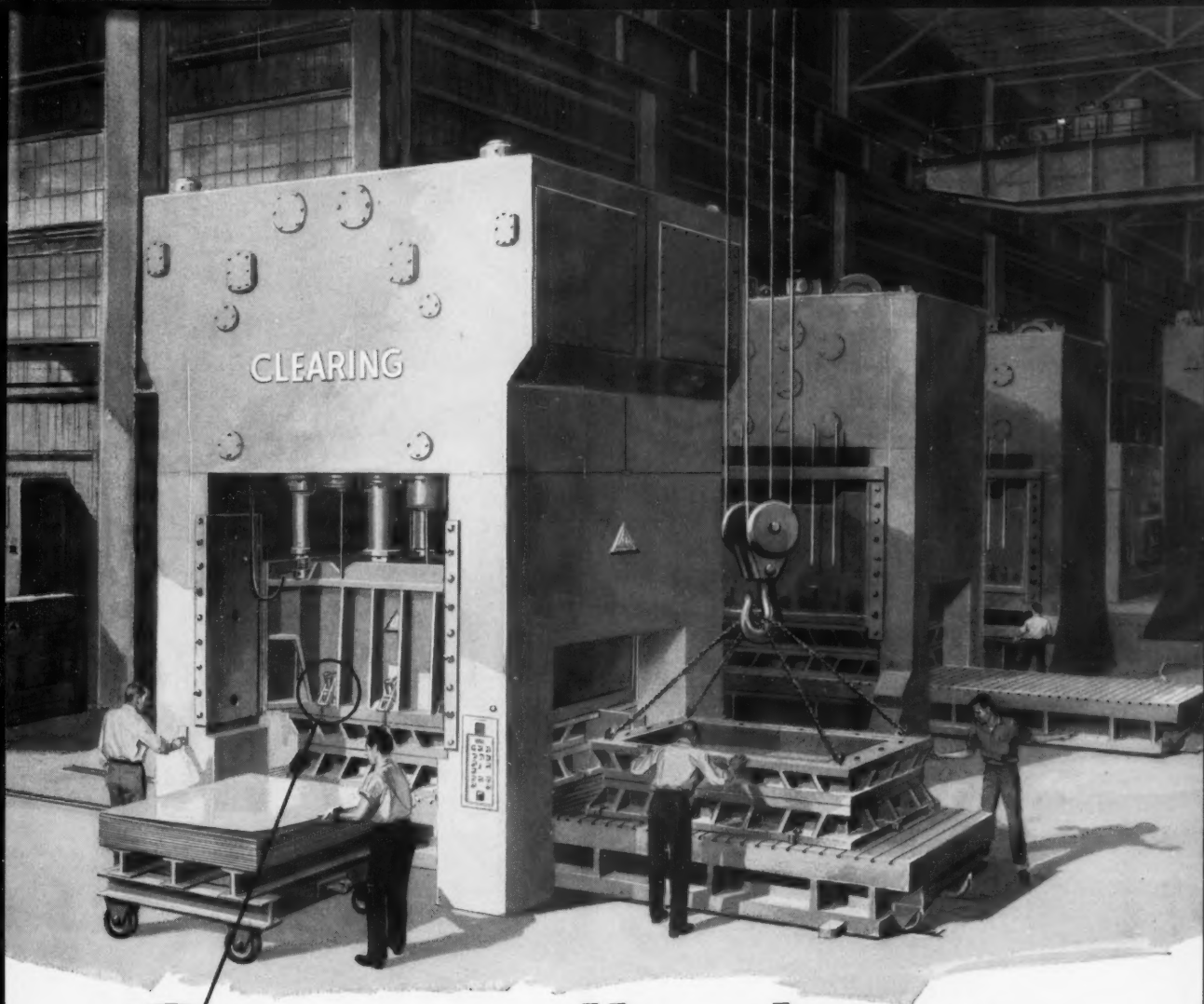
In Canada: LINDE AIR PRODUCTS COMPANY

Division of Union Carbide Canada Limited, Toronto

*Linde*  
Trade-Mark

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.





Hydraulic clamps like this one make it possible to clamp the dies to the slide in a matter of seconds.

## die changes IN MINUTES

### CLEARING Moving Bolster Press offers "PUSH BUTTON" DIE SETTING

You can eliminate hours of non-productive time with the new Clearing moving bolster press shown here. This press has two bolsters—one under the press slide, the other, as shown above, is outside of the die area. The press is set up for its new production run on the outside bolster before the current job is completed. When the run is complete, a button is pushed and the outside bolster rolls into operating position under the press slide.

Quick change hydraulically operated, mechanical locks (inset) make detaching the old dies from the press slide as easy and faster than winding your watch. Locking in the new dies is, of course, just as simple.

"Push button" die setting is one of the many methods Clearing has developed to help you produce more profitably. A Clearing sales engineer will be glad to discuss them with you at your convenience.

WRITE FOR DESCRIPTIVE LITERATURE TODAY.

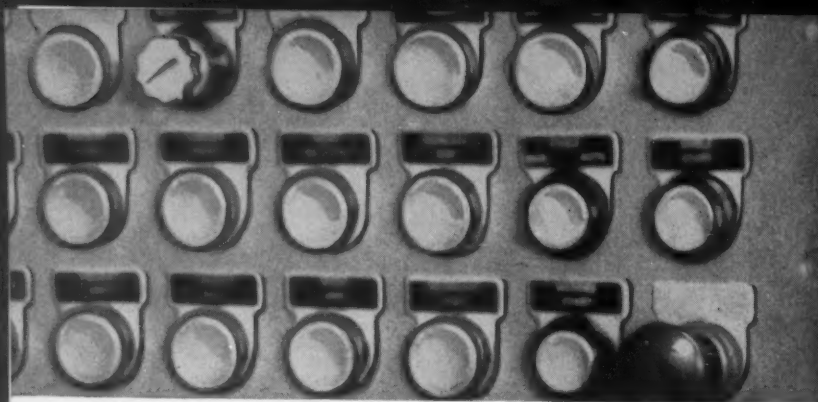
## CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • Division of U. S. Industries, Inc. **USI**

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Division, Hamilton, Ohio





# PUSH-BUTTON ECONOMY





Yesterday, Jones & Lamson broke through the speed barrier with high-velocity metal turning.

Today, advanced engineering at Jones & Lamson again pioneers in attacking a critical cost consideration: the *man-hour* factor.

Here are a few of the engineering innovations which are strategically important for (1) minimizing operator fatigue and human error (2) speedy change-over and retooling, and (3) push-button simplicity of operation:

**In Turret Lathes:** Geneva saddles and Hydra-Clutch headstocks; automatic thread chasing; one- or two-way tracing combined with normal Turret Lathe operation; Numerical Tape Control for Automatic Turret Lathe.

**In Automatic Lathes:** Automatic handling; feed-back; gaging; sorting; chip disposal.

**In Grinders:** Automatic Tap Grinders; Optical Contour Grinders; automatic handling for Thread and Form Grinders.

These are typical results of our all-out efforts toward machine design that will reduce costs, increase production, and keep both operators and management happy.

*The man who needs a new machine tool is already paying for it.*



**JONES & LAMSON MACHINE CO. • 512 CLINTON ST. • SPRINGFIELD, VT.**

Turret Lathes

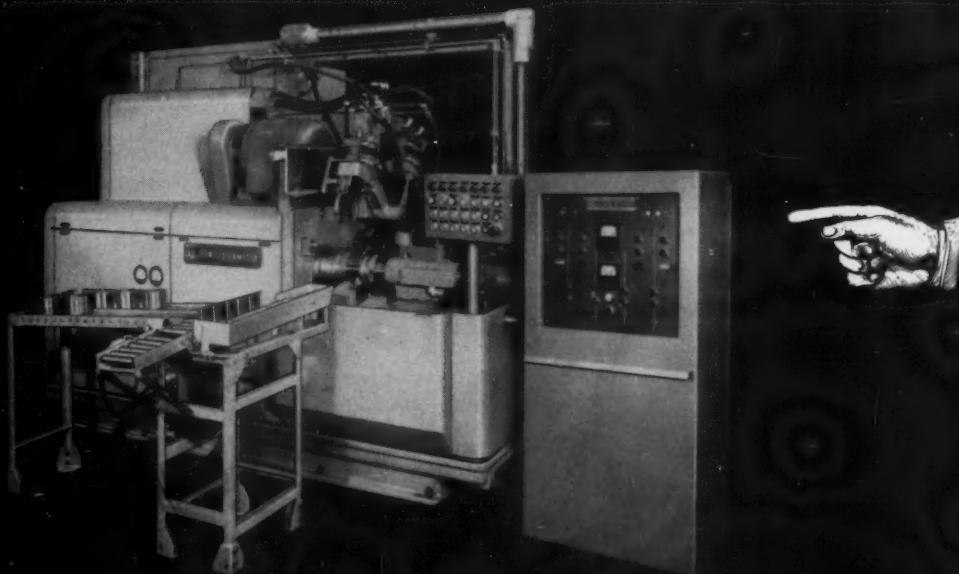
Fay Automatic Lathes

Milling & Centering Machines

Thread & Form Grinders

Optical Comparators

Threading Dies & Chasers



*the finest high production lathes*

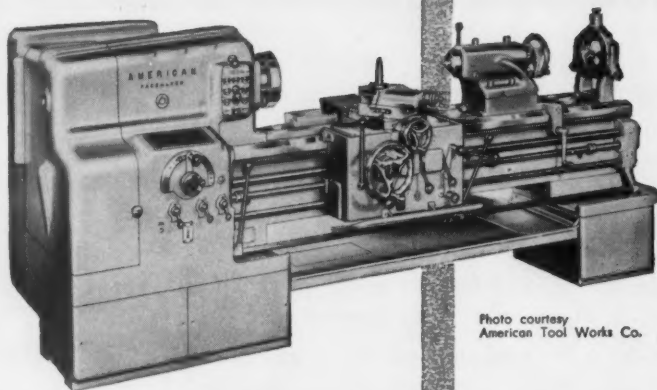
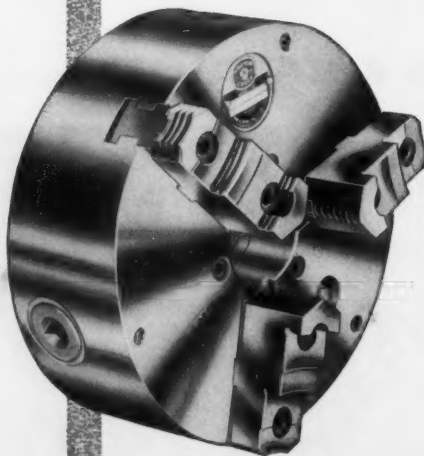


Photo courtesy  
American Tool Works Co.

Here is the new 16" Deluxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

*deserve the finest high production chucks*

This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.



WINDSOR LOCKS, CONN.



# *It **MUST** have been good!*

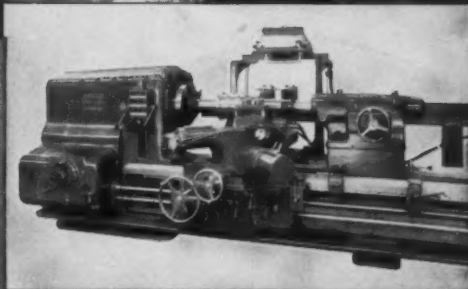
There are times when expressions speak louder than words.

Here's a group of distinguished steel mill roll executives watching a demonstration on a 26" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

If it's proof you want just drop us a line—no obligation.

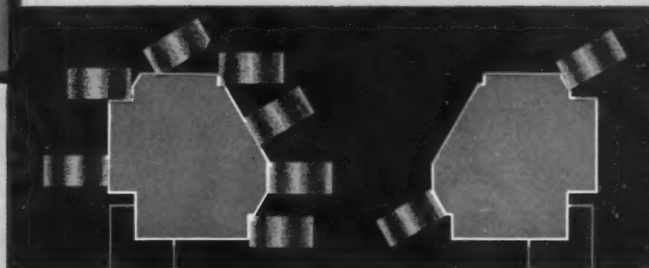
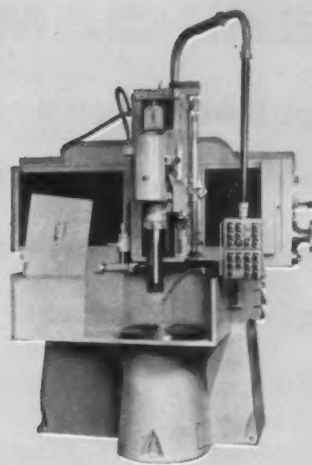


**THE AMERICAN TOOL WORKS CO.**

Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS





## one setup: **nine** jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

Vertical Universal Grinders: swings 18", 24" and 42".

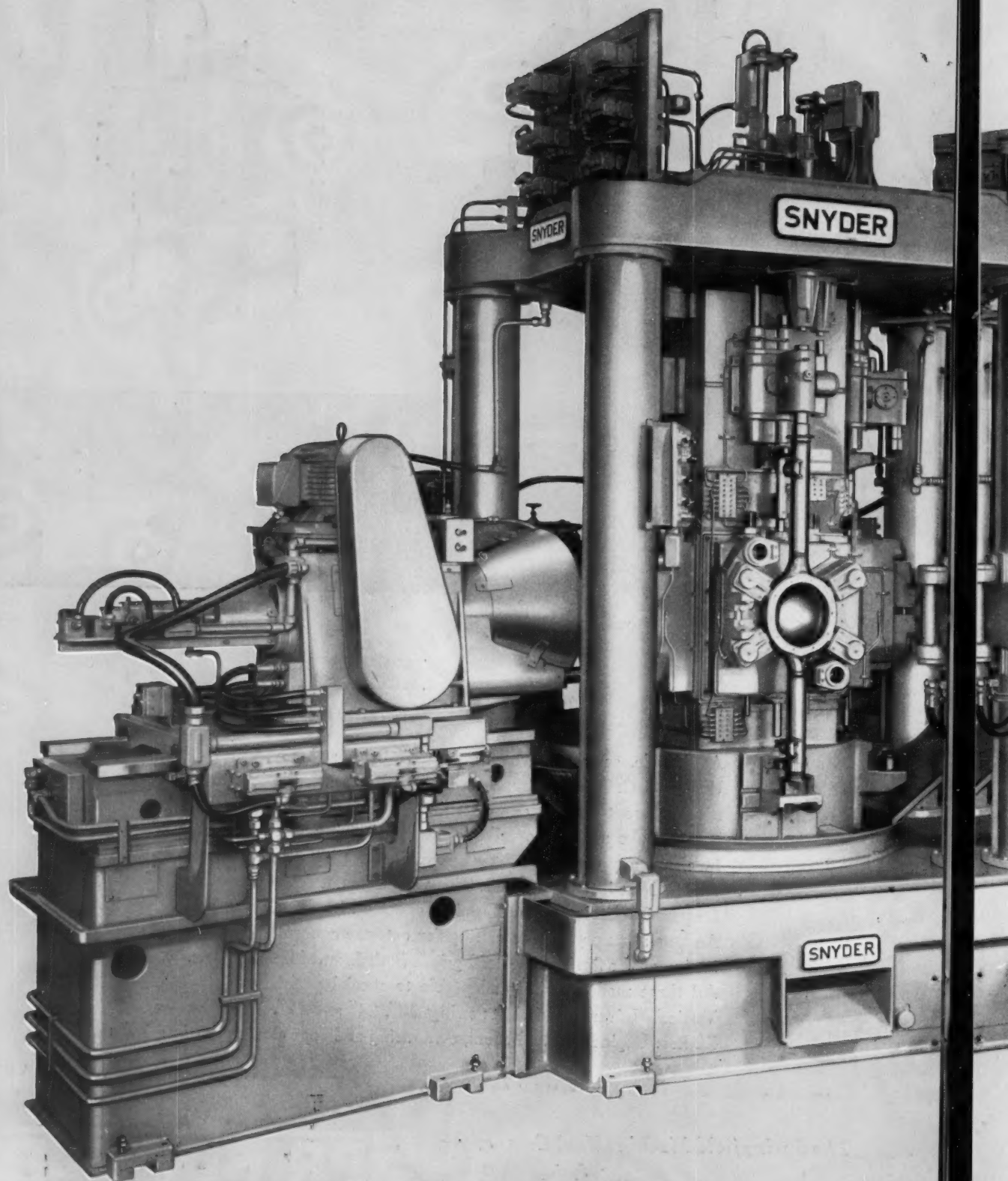
Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".

*The Springfield Machine Tool Company*  
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

# SPRINGFIELD







# **SNYDER VERTICAL TRUNNION MACHINE**

**for processing rear axle housing  
assembly; rough and finish faces  
banjo face, combination drills  
and reams ten holes in banjo  
face and chamfers both sides of  
holes. Production: 105 pieces  
an hour at 100% efficiency.**

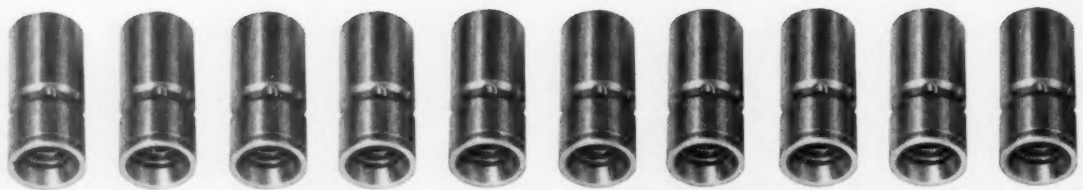


# **SNYDER**

**TOOL & ENGINEERING COMPANY  
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN**

*31 Years of Special Machine Tools with Automation*

## Mr. Smith goes to Florida!



Mr. Smith's books showed an excellent current ratio. His cash position was good; his surplus was substantial. Shortly thereafter, however, he entered a premature retirement.

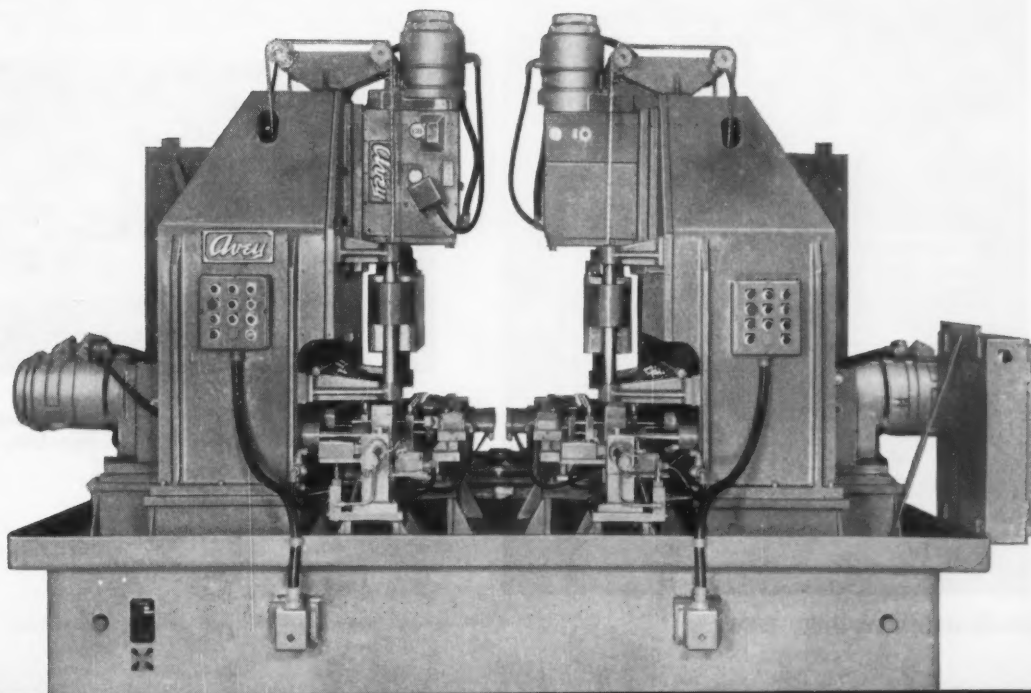
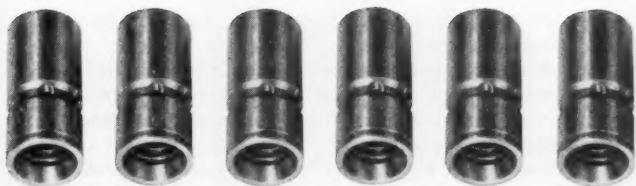
He had overlooked the fact that a large part of his company's fixed assets were machine tools, and their values shown on his balance sheet were simply bookkeeping entries. Those values didn't reflect obsolescence, nor show how expensive indirect labor, non-productive floor space and downtime can be.

A closer look at your balance sheet may reveal the wisdom of investing in new production equipment. Its high rate of return makes good balance sheets better.

► **production data:**—This Avey Line-O-Dex drills and deburrs 3100 body sleeves per hour. On each half of machine, 3 parts at a time are indexed automatically; hydraulically clamped; drilled and deburred. Built to JIC specs except for 2-speed motors, which increase production.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

**drilling, tapping, production machines**





**How would you jig and set up to  
perform nine operations  
on these three holes simultaneously  
in 5.11 seconds  
for 82/100¢ per part?**

**At first glance it looks like a cinch! . . . just use three  
drilling units with combination tools!**

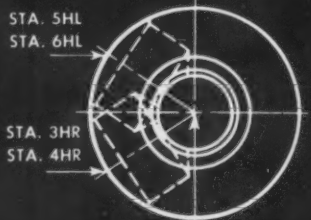
**But each hole must also be reamed, and the part has no  
fixed locating point for a second chucking . . .**

## **"Operations Kingsbury" maintains high**

### **STEEL BAR**

**Eight Operations from three directions**

**700 parts per hour gross  $\frac{82}{100}$ ¢ per part**



**.190/.209 dias. hole**

STA. 1V: Drill 1/2 depth

STA. 2V: Drill full depth

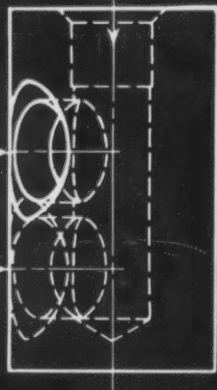
STA. 6V: Chamfer 1/32 x 45

STA. 7V: Comb. Ream

Drill undersize  
and C'sink STA. 3HR  
Ream STA. 4HR

**.253 dia. holes**

Drill undersize  
and C'sink STA. 5HL  
Ream STA. 6HL

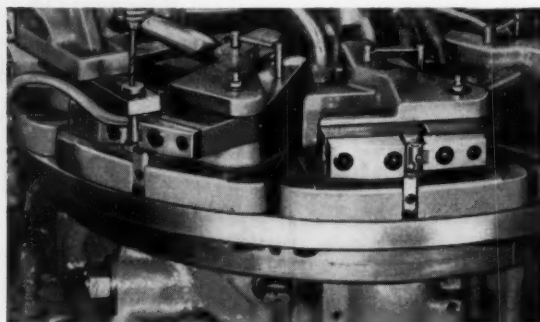


The part is a steel cylinder  $\frac{1}{2}$  inch diameter and  $1\frac{13}{16}$  inch long. Vertical hole is along the axis. Horizontal holes are located on two levels, 67° apart.

Manually-operated work-holding fixtures are designed to hold the part with the axis vertical. It is seated firmly against locators at the bottom, back and left-hand side, and clamped from the right. All operations are performed without removing the part from the fixture.

Six Kingsbury units are mounted on a 60-inch base. Eight work-holding fixtures are mounted on a 20½-inch table, which indexes through eight stations, one used for loading and unloading.

At Stas. 1 and 2 a vertical unit is equipped with a two-spindle auxiliary head. At Sta. 1-V, one spindle drills the .190 dia. axial hole undersize to half depth. A bushing guides the drill. At Sta. 2-V the second spindle drills the hole to full depth. This two-stage operation



**Eight precision-built fixtures accurately mounted on the  
Kingsbury dial assure perfect interchangeability.**



is necessary in order to complete this work within the required time period.

At Sta. 3-HR a horizontal unit with combination tool drills the upper (right hand) .253 dia. hole undersize to connect with the axial hole. It also forms the counter-sink. A similar unit at Sta. 4-HR reams this hole. Bushings guide the tools.

Identical operations are performed on the lower (left hand) hole at Stas. 5-HL and 6-HL.

At Stas. 6 and 7, a vertical unit is equipped with a two-spindle auxiliary head. Spindle at Sta. 6-V chamfers the axial hole  $\frac{1}{16}$  x 45°. Spindle at Sta. 7-V

combination step-reams the hole to .190/.209 diameters, removing the burrs from the break-through of the two horizontal holes.

\* \* \*

Going back to our first premise: it's a cinch — *on a Kingsbury*. But what makes it a cinch? Specially designed work-holding fixtures that are uniformly accurate. Kingsbury heads, bases, indexing tables, electrical controls — all working together in perfect *automation* — *plus* the experience and skill of our engineers who are always looking for better ways to make better Kingsburys. Let us show you!

Kingsbury Machine Tool Corp.  
118 Laurel St., Keene, N. H.

## production of interchangeable parts at low cost



**KINGSBURY**

**AUTOMATIC DRILLING  
AND TAPPING MACHINES**  
for Low-Cost High Production

**ANTISEP**

the all-purpose water-soluble cutting base



## COOL PROFITS -- when **ANTISEP** works for you

Longer tool life, higher quality work, more output per machine . . . all at a cost of 8c per gallon of coolant in the machine! That's the kind of increased profit story that is being repeated in shop after shop where ANTISEP is on the job.

ANTISEP All-Purpose Base gives you everything you want for tough machining jobs. Its extra lubricity insures fast, free cutting on tough metals. Its high film strength and anti-welding properties help prevent

chip build-up on tools. Because it is mixed 25 to 1 with water, it keeps tools and work cooler than any straight cutting oil could. You can step up production and still have a smoke-free plant and finer finished work.

Decide today to try ANTISEP. Your Houghton Man will be glad to arrange a test in your plant . . . or write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

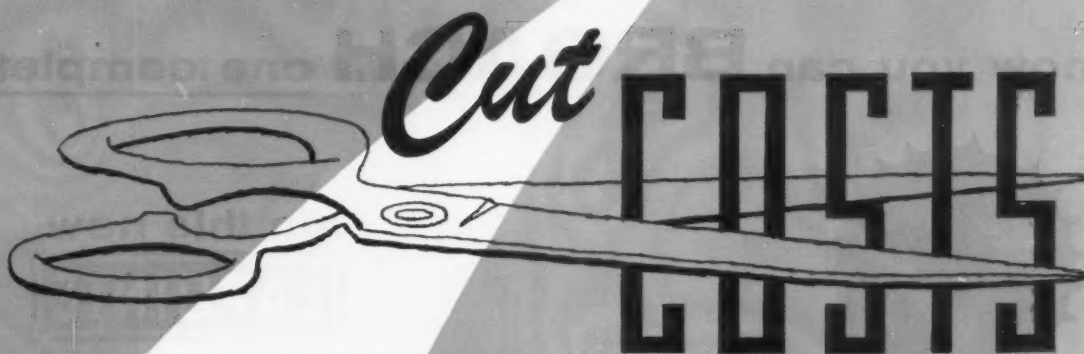
**ANTISEP** all-purpose cutting base

...a product of

**E. F. HOUGHTON & CO.**  
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO



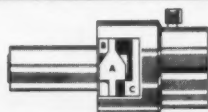
Ready to give you  
on-the-job service . . .



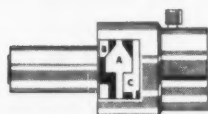
## with **R and L** TAP AND DIE HOLDERS



*New Release Mechanism  
allows for easy adjustment  
for right or left hand  
tapping and threading.*



Ready to start threading operation, clutch slightly engaged at C.



Instantly engaged to full contact between A and C as soon as tap or die engages work.



Fully released showing ample clearance between contact points of clutch.

Instant engagement  
at full contact . . . Fast  
kick out clutch . . . No spring  
plungers to wear or break . . .  
No small screws to work loose!  
Available with shanks of from  $\frac{5}{8}$ " to  $1\frac{1}{2}$ "  
in releasing and non-releasing types as well as  
releasing die holders for acorn dies.

See R and L Tools at booth 741, ASTE Industrial Exposition, Chicago, March 19th-23rd.

*Send for new  
catalog*

**R and L TOOLS**  
1825 Bristol Street, Philadelphia 40, Pa.

- ☐ Send new catalog  
☐ Please have representative call.

NAME .....

COMPANY .....

ADDRESS .....

M-7

RIGHT
R and L
LEFT

TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-  
 RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES  
 • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL •  
 REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—61

now you can **BROACH** one complete

on this new  
**LAPORTE**  
horizontal  
**BROACHING MACHINE**

Broaching 10 times faster than conventional type horizontal machines, this new LAPORTE horizontal machine, with electro-motive drive, broaches a 25-tooth sprocket in *exactly 60 seconds!* Accurate, too — holding a tolerance within .002".

Built heavy and rugged for amazingly smooth operation, and capable of broaching-speeds up to 300 feet per minute, it's a "natural" for *carbide tooling*.

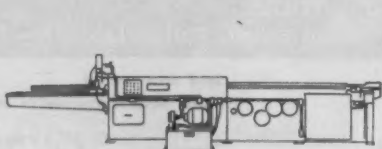
This machine can also be adapted to broaching GEARS, and CIRCULAR SAWS; and similar parts with repetitive form on the periphery. Doesn't all this give you an idea for using this broaching machine to solve some of your troublesome production problems? One of our experienced sales engineers will gladly discuss the subject with you . . . a request for information will bring a prompt reply.

**THE LAPORTE MACHINE TOOL COMPANY**

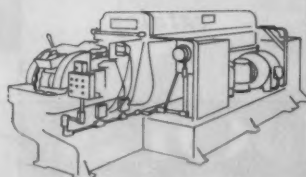
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

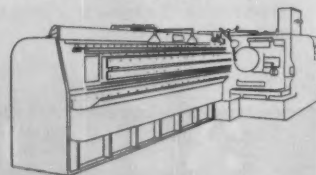
Here's a line of **ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . available only at LAPORTE**



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

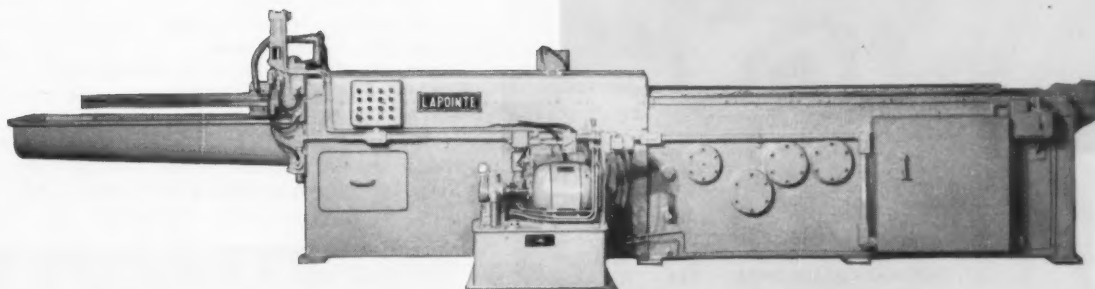


**sprocket per minute**

**with electro-motive drive**



Pulsation-free, and broaching at uniform speed regardless of load, this newest LAPOINTE Broaching Machine with electro-motive drive, 60-inch stroke, broaches sprockets 2-at-a-time, at a broaching speed of 150 feet per minute.

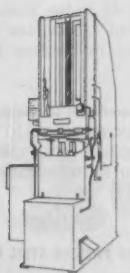


*LAPOINTE takes all the responsibility for your broaching program. We build the broaching machines, build the broaching fixtures, and make the broaches!*

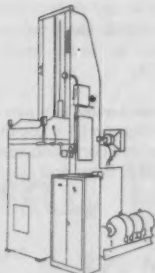
Change Gear Fixtures are available for broaching sprockets in a series of ranges from

- 4" to 20" diameter
- 18 to 112-tooth sprockets
- $\frac{3}{8}$ " to  $\frac{3}{4}$ " pitch

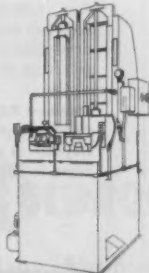
Fixtures and tooling can be provided for larger sprockets and a greater number of teeth.



VUE-7 VERTICAL  
PULL-UP ELECTRIC



SRVE SINGLE RAM  
VERTICAL, ELECTRIC

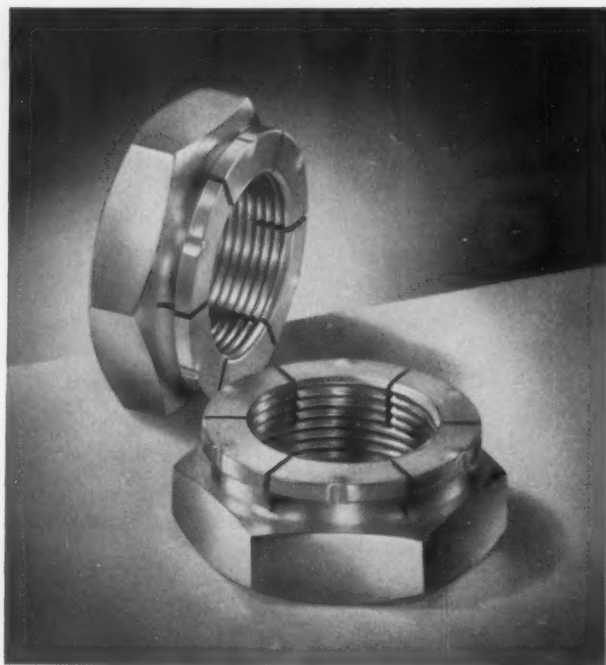


DRVE DOUBLE RAM  
VERTICAL, ELECTRIC

**LAPOINTE**

known to be the best in  
**BROACHING**

# Flexloc thin nuts save space, weight and production time



SPECIFICATIONS  
FLEXLOC THIN NUTS



NATIONAL COARSE THREAD—U.S.S.

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-32	.312	.125	.361	1.8
8-32	.344	.172	.397	2.8
10-24	.375	.172	.433	3.3
1/4-20	.438	.203	.505	5.4
5/16-18	.563	.250	.649	11.6
3/8-16	.625	.265	.722	14.9
7/16-14	.750	.312	.866	24.9
1/2-13	.813	.312	.938	28.4
9/16-12	.875	.359	1.010	36.1
5/8-11	1.000	.391	1.155	54.1
3/4-10	1.125	.406	1.299	69.2
7/8-9	1.312	.469	1.516	107.5
1-8	1.500	.563	1.732	171.6

NATIONAL FINE THREAD—S.A.E.

6-40	.312	.125	.361	1.8
8-36	.344	.172	.397	2.8
10-32	.375	.172	.433	3.3
1/4-28	.438	.203	.505	5.4
5/16-24	.500	.250	.577	8.7
3/8-24	.563	.266	.649	11.5
7/16-20	.625	.312	.722	14.9
1/2-20	.750	.312	.866	21.7
9/16-18	.875	.359	1.010	36.2
5/8-18	.938	.391	1.082	42.4
3/4-16	1.063	.406	1.227	54.5
7/8-14	1.250	.469	1.443	84.6
1-14	1.438	.563	1.660	136.3
1 1/8-12*	1.625	.625	1.876	193.5
1 1/4-12*	1.813	.750	2.093	296.0
1 1/2-12*	2.000	.812	2.309	389.0
1 3/4-12*	2.187	.875	2.526	498.0

\*Steel only (plain or cadmium plated) in stock sizes.

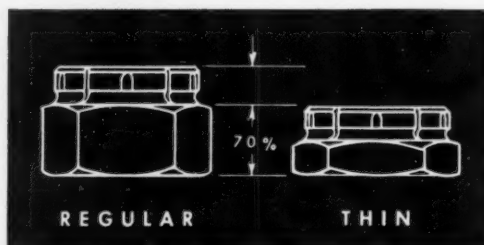
**Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools**

Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.



**FLEXLOC thin nuts are 30% lower** than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/16 in., thin FLEXLOCs meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.

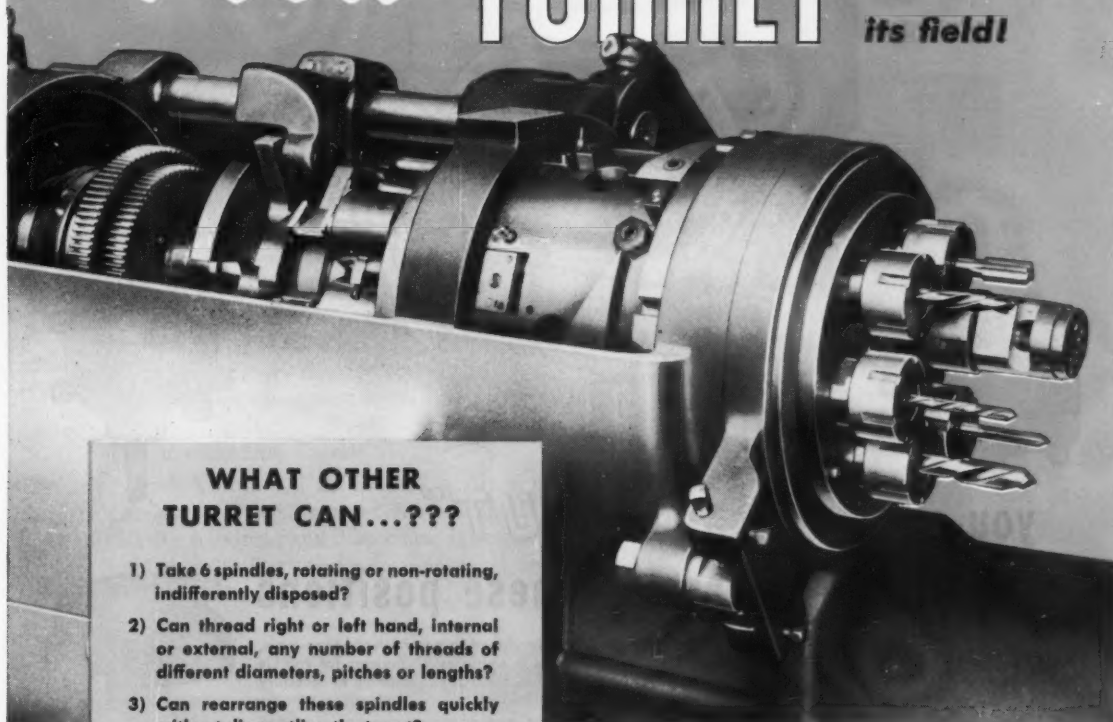
**FLEXLOC** LOCKNUT DIVISION

**SPS**

JENKINTOWN PENNSYLVANIA

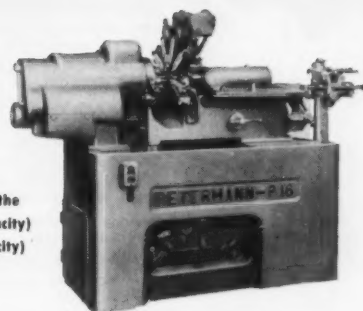
# THE *New* PETERMANN TURRET

**Absolutely  
unique in  
its field!**



## WHAT OTHER TURRET CAN...???

- 1) Take 6 spindles, rotating or non-rotating, indifferently disposed?
- 2) Can thread right or left hand, internal or external, any number of threads of different diameters, pitches or lengths?
- 3) Can rearrange these spindles quickly without dismantling the turret?
- 4) Can supply a variety of speeds, at will, by simple positioning of pins? No special cams or gear changes!
- 5) Offset the turret drum for recessing, etc., quickly and easily?
- 6) Provide fast approach and return of any spindle, without special cams, by simple positioning of trip dogs?
- 7) Index the turret in  $\frac{3}{5}$  of a second? This is constant, not dependent on the cycle time!



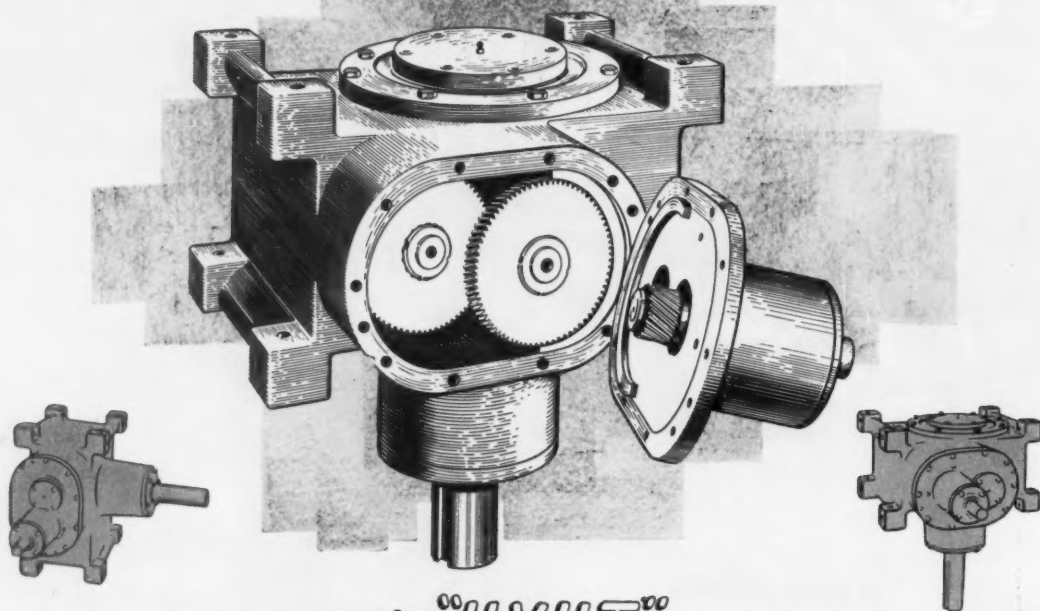
Supplied with the  
P-16 ( $\frac{5}{8}$ " Capacity)  
P-25 (1" Capacity)

**RUSSELL, HOLBROOK & HENDERSON, INC.**

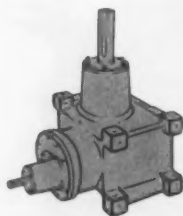
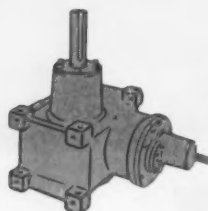
292 Madison Avenue, New York 17, N. Y.

**Now - a truly Flexible Mounting**  
UNIVERSAL CHANGE-SPEED

# Conveyor Drive



you can mount the **"HVUT"**  
in any of these positions



The Phillie Gear "HVUT" Speed Reducer was developed from many years' experience, especially for application to Conveyor Drives. It embodies all features for Flexible Mounting, plus wide range of output speeds, and the rugged durability so necessary for conveyor installations—yet all at a low initial cost.

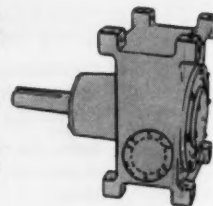
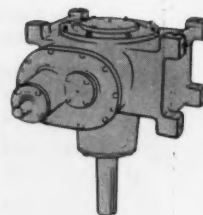
Particularly important to Conveyor Users, is the ease of changing the output speed—within a matter of minutes, the helical gear chamber may be opened and gearing replaced to alter the output speed. This versatile Reducer can be applied to most any type of Conveyor: floor, trolley, and pit—and it is also being used for other applications in industry, where unusual versatility is required.

The "HVUT" Unit may be mounted in any of the positions shown above, and when the shaft is mounted in a vertical down position, it is ideal for the overhead conveyors, which are so widely used in the automotive industry; also, the dust-proof housing makes it very desirable for pit type conveyors. When the output shaft is mounted in a vertical up position, the "HVUT" Reducer is excellent for Tow line Conveyors.

The Philadelphia Limitorque feature can also be furnished with these conveyor drives. The Limitorque device instantly breaks the motor circuit in the event of a conveyor jam or severe overload.

Gearing, bearings, and housing of the "HVUT" Unit is manufactured in strict accordance with AGMA Standards... Standard reduction ratios from 50:1 to 1800:1 in six unit sizes can normally be delivered promptly from stock.

Send for Booklet describing and illustrating unusually versatile Reducers.



## phillie gear®

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS  
Virginia Gear & Machine Corp. • Lynchburg, Va.



**"The right quench oil for our work is**

# **SHELL VOLUTA OIL 23"**

says Garland Wilcox, Chief Metallurgist  
Wallace Barnes Co., Bristol, Conn.

## **...the story of a profitable change**

WALLACE BARNES COMPANY and steel springs have "gone together" for nearly a century. Most of today's output is in SAE 1075 or 1095 steel.

Because the quenching operation is so important to the life of springs, the Wallace Barnes laboratory decided to test its regular quenching oil against some of the newer products, including Shell Voluta Oil 23. This is what they found:

Shell Voluta Oil 23 showed a superior quench rate, with correct hardening and relative freedom from distortion. It drained more rapidly from the quenched parts, re-

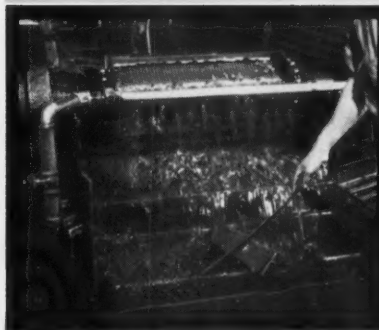
ducing dragout loss. It washed off more completely in the alkaline cleaner; it reduced flaming, and cut down on the oil baked to parts.

Wallace Barnes reports that this oil has almost eliminated trouble with "slack-quenched parts," and that heavier stock now goes through without special handling. So . . . Shell Voluta Oil 23 has replaced the former quench oil in all tanks of the spring hardening departments, serving salt pot lines and shaker hearth furnaces.

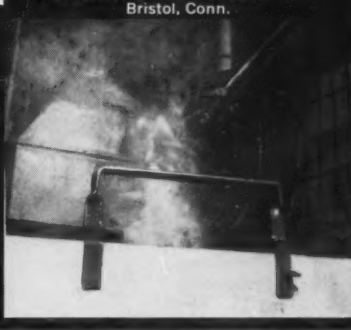
We'll be glad to provide full information on Shell Voluta Oil 23.

**WALLACE BARNES CO.**  
A division of Associated Spring Corp.  
Bristol, Conn.

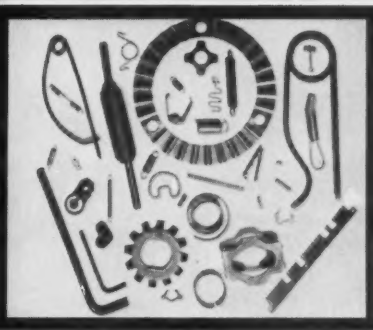
Photos courtesy "STEEL"



Shaker hearth furnaces automatically dump parts into Shell Voluta Oil 23, then remove and drain them.



Flat springs at austenitizing temperature get a fast quench in Shell Voluta Oil 23.



Over 35,000 prints of production items like these are kept on file at Wallace Barnes Co.

## **SHELL OIL COMPANY**

50 WEST 50TH STREET, NEW YORK 20, NEW YORK  
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA



For more information fill in page number on Inquiry Card, on page 261

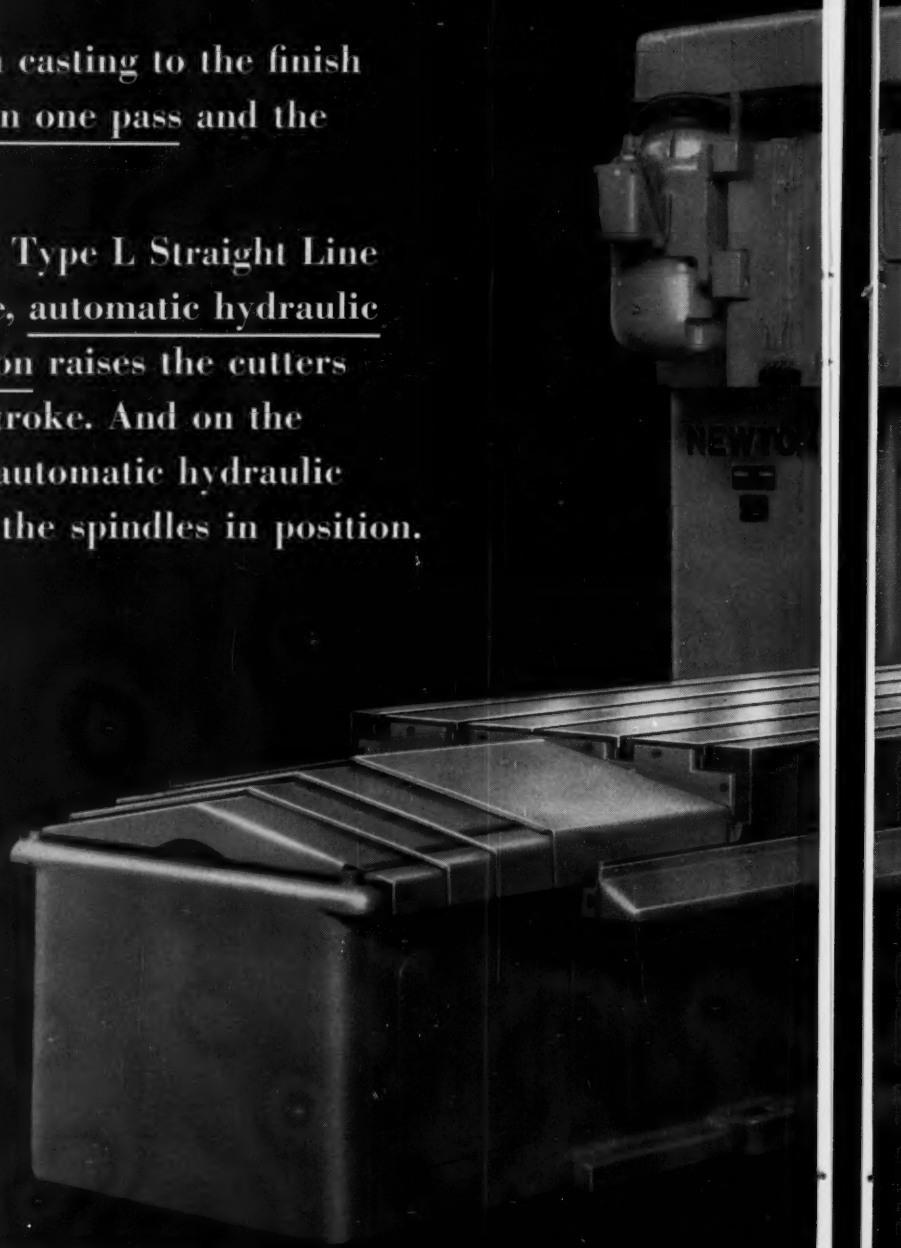
MACHINERY, July, 1956—67

# One Pass . . . and

From the rough casting to the finish milled surface in one pass and the job is done!

On this Newton Type L Straight Line Milling Machine, automatic hydraulic spindle retraction raises the cutters on the return stroke. And on the milling stroke, automatic hydraulic clamping locks the spindles in position.

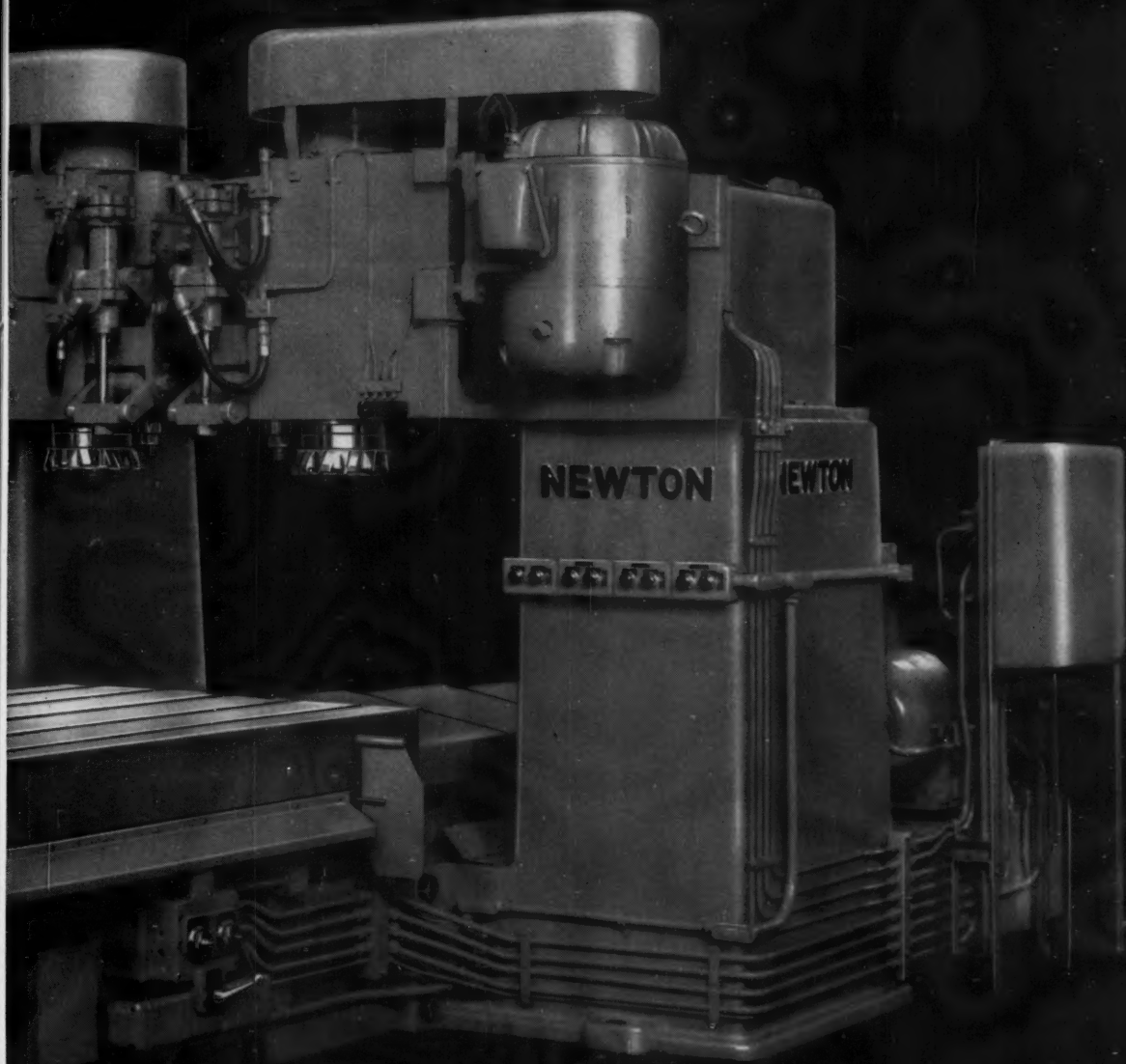
Newton Type L Straight Line Milling Machine with 20 H.P. heads for one-pass milling of aluminum crank cases.



CONSOLIDATED MACHINE TOOL

*A Division of Farrel-*

*the Job is Done!*



---

COMPANY, ROCHESTER 10, N. Y.

*Birmingham Company, Incorporated*

# Cincinnati Shear's

## and ACCURATE

*Photos courtesy Despatch Oven Company, Minneapolis, Minnesota.*

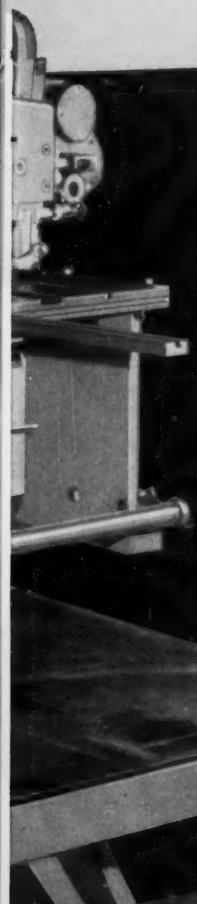


New front controlled power back gauges are now standard equipment on ALL CINCINNATI SHEARS.



**fast, easy**

**gauge setting... ***SAVES TIME!*****



Cincinnati features bring speed and accuracy in turning out panels for industrial ovens at the Despatch Oven Company.

5' x 10' sheets are trimmed four sides—corners are square, sides are clean and straight and panels are sheared accurately to size.

Cincinnati quick, convenient and positive gauging, accurate knife alignment and powerful hydraulic hold-downs speed performance.

Despatch Oven Company say—"This shear has brought an operating time saving, reduced time for maintenance. Performance very good."

**Write for Shear Catalog S-7.  
If you shear we can help you.**

**THE CINCINNATI SHAPER CO.**

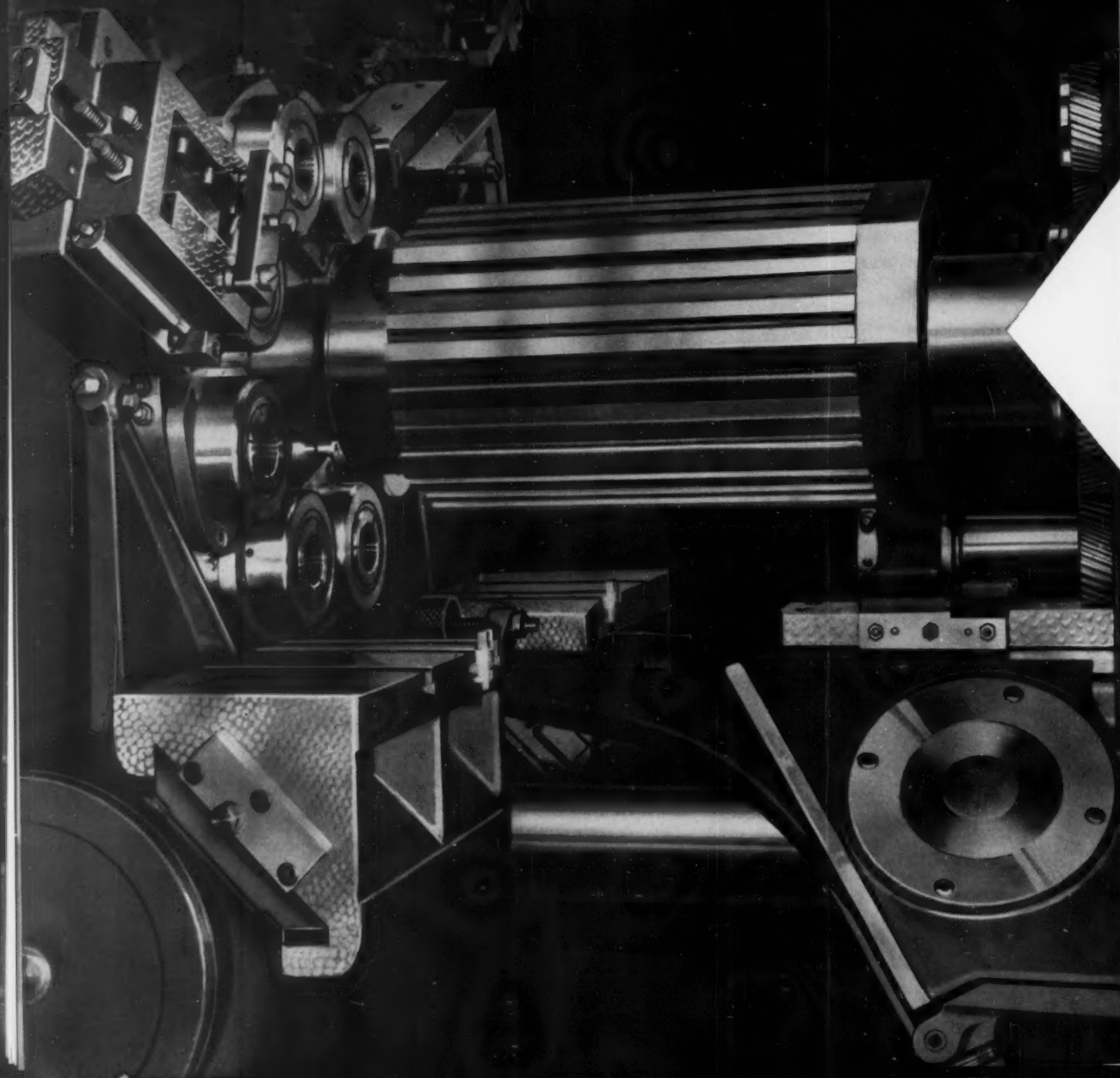
CINCINNATI 25, OHIO, U.S.A.

SHAPERS • SHEARS • BRAKES



the tooling zone of every

*Acme-Gridley*



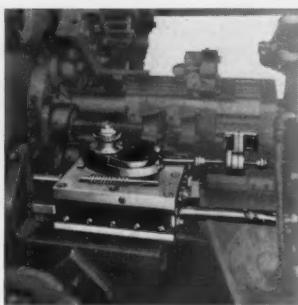
# —open... for business!

Since the primary advantage of a multiple-spindle automatic is to make it possible to complete more operations in a single setup, accessibility to and plenty of space in the tooling zone, to apply the maximum number of tools, is especially significant.

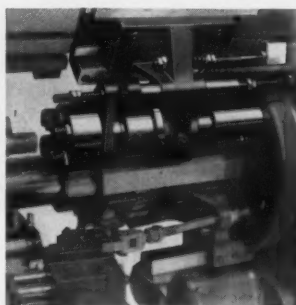
When you want to speed up production, perform unusual operations, or to get a finer finish, let a National Acme tooling engineer apply his COMPLETE LINE experience in helping you select the attachments to perform these operations on your machine.



Combination Cross Milling and Drilling Attachment



Worm or Thread Generating Device



Threading or Tapping Tool

## LET US TELL YOU MORE ABOUT *Acme-Gridley* BASIC DESIGN

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

# National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES:

Newark, N. J.

Chicago, Ill.

Detroit, Mich.

# ARMSTRONG



The ARMSTRONG Thread-Ing Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

## Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market...are used by over 96% of the machine shops and tool rooms...are carried in stock for your convenience by all industrial distributors of consequence.

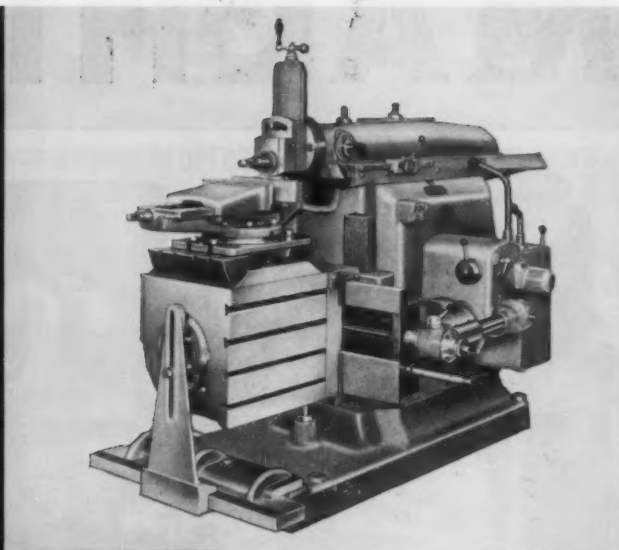
*Write For Catalog*



**ARMSTRONG BROS. TOOL CO.**

"The Tool Holder People"  
5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.





VMA Universal Shaper Model ES-26



## UTOMORDENTLIG YRKESKICKLIGHET

(SUPERB CRAFTSMANSHIP)

VMA SHAPERS - built by Sweden's master craftsmen - are engineered to maintain precise tolerances in continuous heavy-duty production. Built to U. S. standards, VMA Shapers—both heavy duty and standard models—meet all requirements for modern versatile machines.

**VMA Model ES Heavy Duty Shapers**, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
- Double helical crank gear
- Chrome nickel steel transmission

- Anti-friction bearings throughout
- Dependable safety clutch

**VMA Model EV Series**... economical standard-duty Shapers with stroke lengths from 14" to 24".

• Highly accurate and dependable, Model EV Shapers are ideal for job shop or tool room use not requiring the extra power of the ES Series. Easy to operate—economical to own.

# @ustin

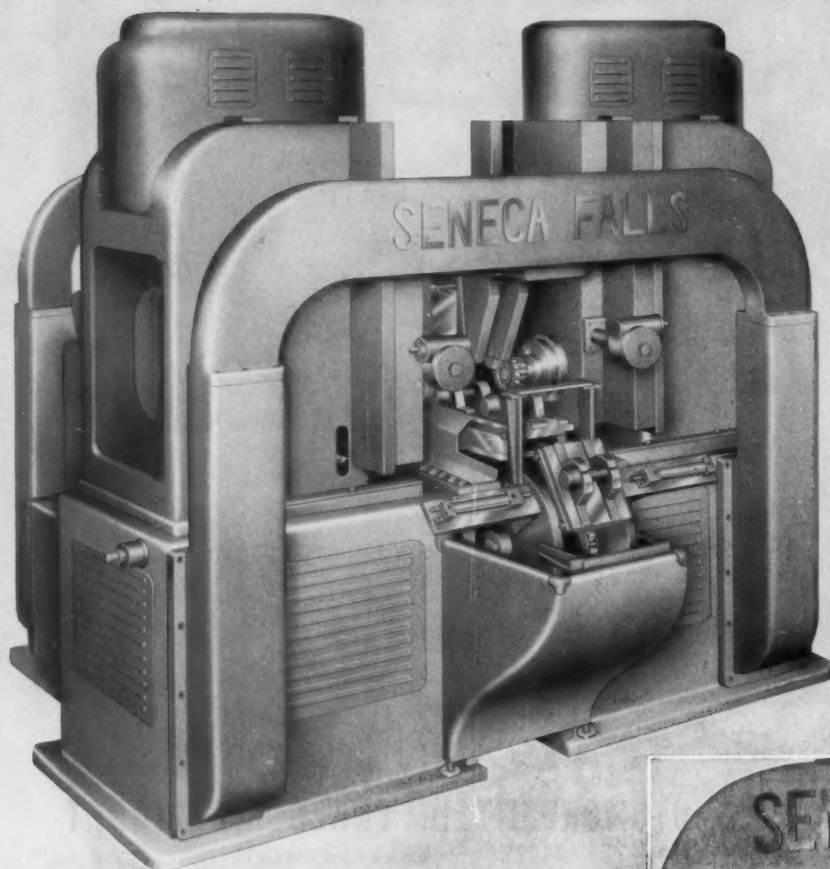
INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—75

# MACHINE OF



Write Seneca Falls Machine Co.,  
Seneca Falls, N. Y. for  
Bulletin MX-B

◀ *Front view of Model MX Milling and Centering Machine showing milling stations. Loading and unloading of work pieces is done at this end of the machine, although an unloading station can be provided at rear of the machine if desired.*

*Rear view of machine showing centering station. Work carriers, attached to an endless chain, carry finished pieces horizontally thru the machine tunnel to the front loading and unloading station.*



## MODEL MX DESIGN FEATURES

- ▶ High production, multiple station, fully automatic machine.
- ▶ Standardized tool carrying heads.
- ▶ Ease of tool and cutter changing.
- ▶ Automatic in-line work transfer from station to station.
- ▶ Automatic cycle interruption in case of overload on tools.
- ▶ Automatic rapid traverse movement for all tool heads.
- ▶ Ease of loading and unloading.
- ▶ Automatic power clamping devices.
- ▶ Hardened and ground ways for work carriers.
- ▶ Motorized chip disposal.
- ▶ Simplified maintenance.
- ▶ Manual push-button operation.



# PROFIT ENGINEERED

# THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swingy PEOPLE" SENECA FALLS, NEW YORK

## NEW... SENECA FALLS AUTOMATIC TRANSFER TYPE, MILLING AND CENTERING MACHINE

● The new Seneca Falls Model MX Double End, Transfer Type, Automatic Milling and Centering Machine is designed to insure accuracy and reduce manufacturing costs on milling to length and centering operations by combining these operations on a single machine serviced by one operator.

The machine is of the horizontal, indexing transfer type with mechanical feeds and positive drive devices. Strength and rigidity characterize the massive base and columns which support the milling heads. The box type columns absorb vibration from heavy cutting loads imposed by carbide milling cutters operating at high cutting speeds and coarse feeds.

Double end, multiple work head design and construction maintains definite relations between milled ends and centers of the work pieces which are securely clamped on individual platens during the entire machining operation.

The machine illustrated is equipped for rough and finish milling operations as well as for the centering operations. However, design is such that single, face milling heads may be supplied in combination with other type heads for end milling driving slots in the face of the work pieces or for combined drilling, reaming, boring, threading and tapping operations in one or both ends of work pieces.

The Work Holding and Work Transfer Mechanism operates on the endless chain principle and the work carriers are indexed from one cutter head to another as the work pieces progress from the loading station to the rough

milling, finish milling and center drilling stations. All work carriers are stationary during actual machining operations.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

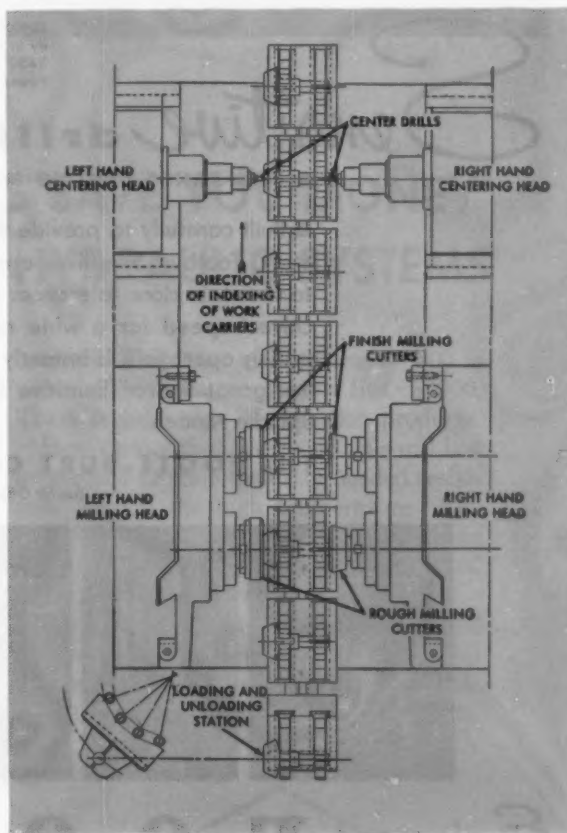
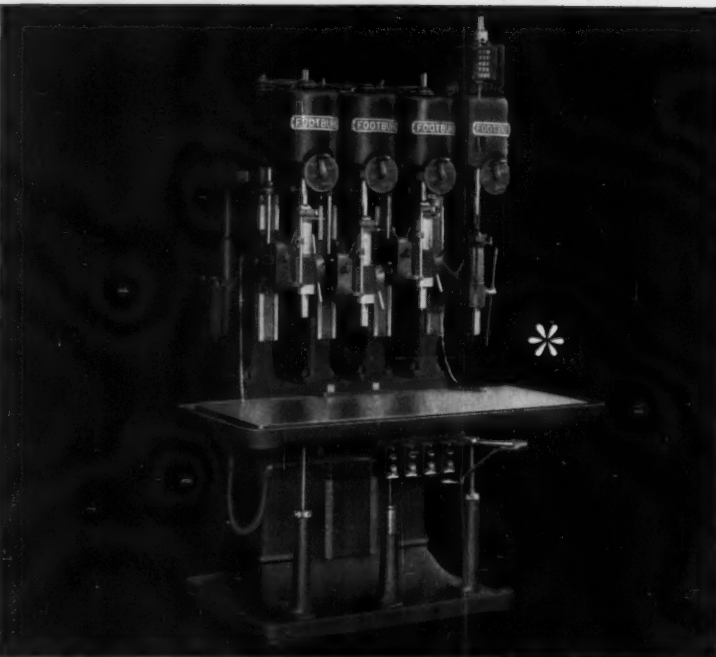


Diagram of flow of work pieces thru Seneca Falls Model MX Automatic Milling and Centering Machine.

BY SENECA FALLS

FOOTBURT  
FOOTBURT  
FOOTBURT  
FOOTBURT  
FOOTBURT  
FOOTBURT  
FOOTBURT



■ No. 2 Machine with Back Gear • 12" Overhang •  $\frac{3}{8}$ " Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

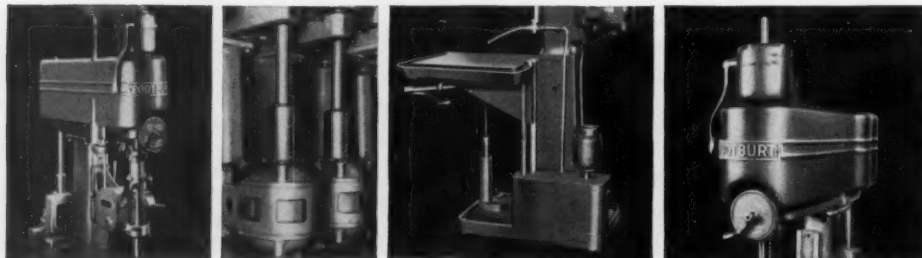
## *Sensitive* **drilling machines**

A FULL RANGE DRILLING MACHINE ENGINEERED FOR PRODUCTION

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitive are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counter-boring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.

**THE FOOTE-BURT COMPANY • Cleveland 8, Ohio**

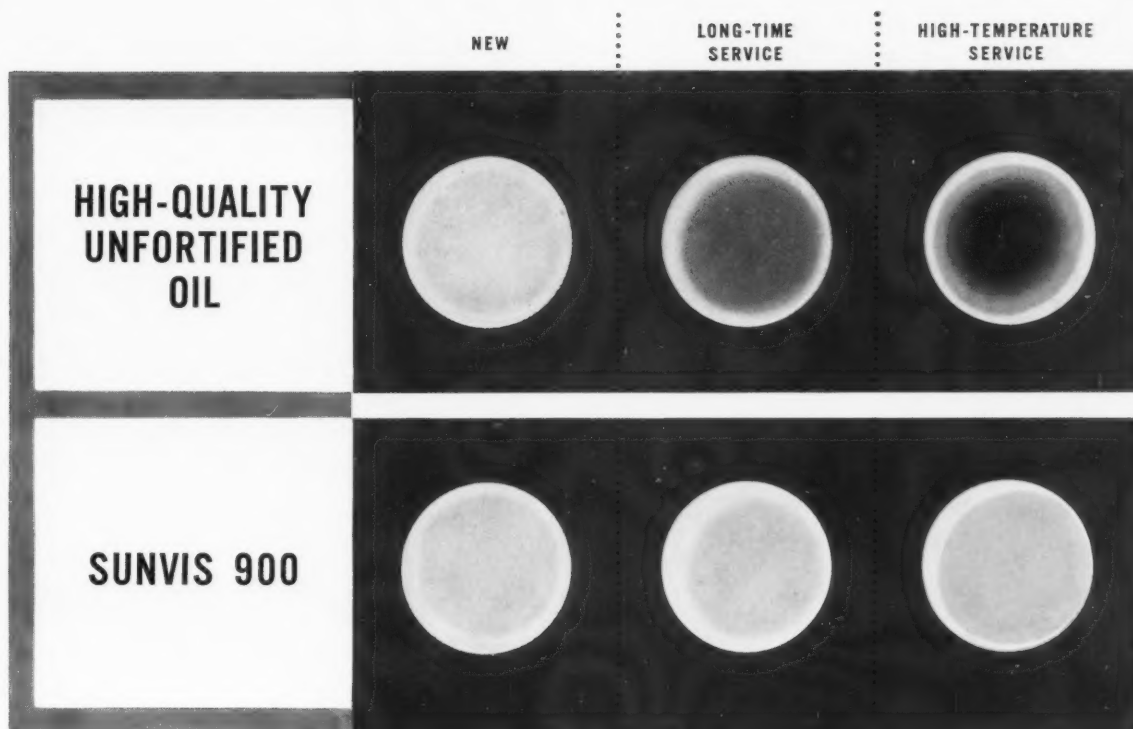
Detroit Office: General Motors Building



*Engineered  
for  
production*

**FOOTBURT**  
**MACHINE TOOLS**





Oil color tests show

## WHY SUNVIS 900 OILS SAVE YOU MONEY IN CIRCULATING AND HYDRAULIC SYSTEMS

Color means very little in brand new oils. But...color *change* during service can mean a lot. While minor darkening is seldom serious, radical color changes indicate danger, except, perhaps, in a highly detergent oil.

Either the oil is contaminated by foreign matter, or as in the pictures, the oil has oxidized from heat and long use. The products of oxidation darken the color of ordinary oils...clog valves and filters, cause excessive maintenance.

Compare the appearance of the used Sunvis 900 with the appearance of the other

used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

Here's proof that Sunvis 900 oils will last longer and provide the extra needed resistance against the high temperature "hot-spots" of typical hydraulic and circulating systems. *For the long run, a Sunvis 900 oil is the most economical oil you can buy.*

For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-31.

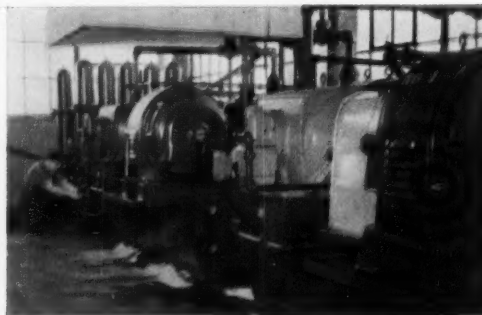
INDUSTRIAL PRODUCTS DEPARTMENT  
**SUN OIL COMPANY**  
Philadelphia 3, Pa.

© SUN OIL CO.



In Canada: Sun Oil Company Limited, Toronto and Montreal

**High-Pressure Pumps**, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



## NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

This is just part of the story about Sunvis 900 oils. Why not talk them over with your Sun representative the next time he calls. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-32.

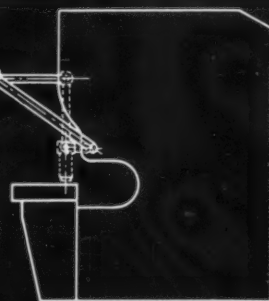


INDUSTRIAL PRODUCTS DEPARTMENT  
**SUN OIL COMPANY**  
Philadelphia 3, Pa. © SUN OIL CO.

In Canada: Sun Oil Company Limited, Toronto and Montreal

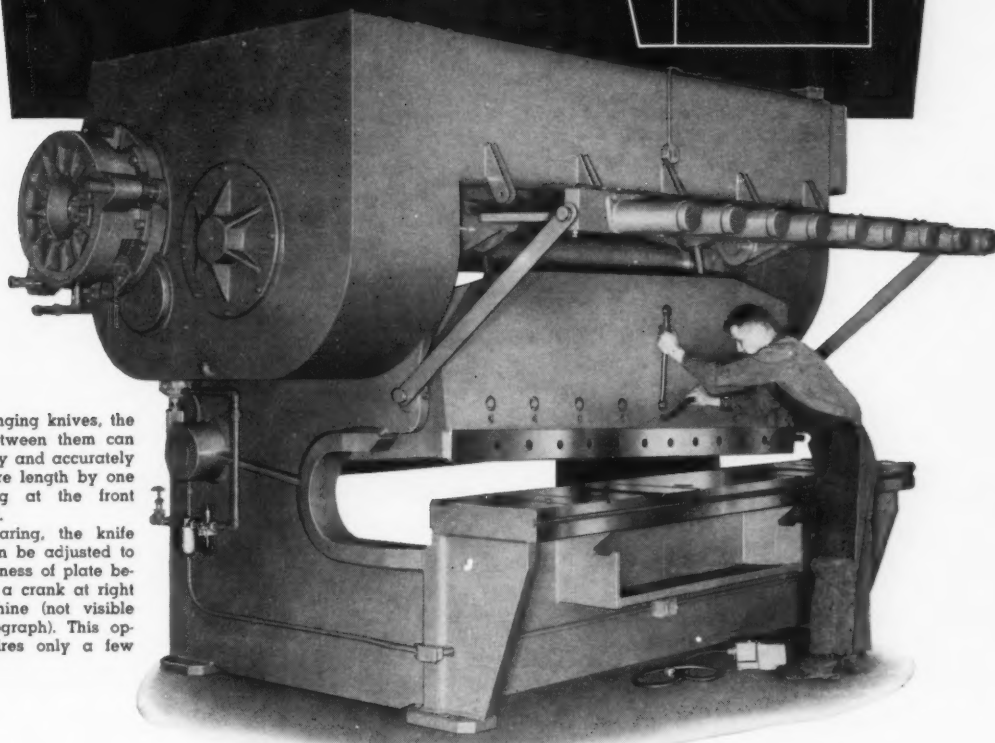
# Knife Adjustment...

Easy and Convenient on  
**STEELWELD SHEARS**



When changing knives, the clearance between them can be set quickly and accurately for their entire length by one man working at the front as illustrated.

When shearing, the knife clearance can be adjusted to suit the thickness of plate being cut with a crank at right end of machine (not visible in this photograph). This operation requires only a few seconds.



When the knives on a Steelweld Shear are being set parallel from one end to the other, it is not necessary to have one man at the rear of the machine turning adjustment bolts, with another man at the front gauging the knife clearance. Nor is it necessary to work between or behind the hold-downs in hard-to-reach places.

On Steelwelds the hold-down beam can be lifted out of the way and all knife adjustment bolts reached from the front of the machine. As each bolt is turned, the clearance can be checked

at once. One man can make the entire adjustment in a small fraction of the time usually required.

After the knives have been set for parallel, the clearance between them can be adjusted to suit various plate thicknesses to obtain the best possible cuts. This can be done in a few seconds by turning a crank and watching a dial indicator.

Because knife adjustments have been made so convenient on Steelwelds, shear operators will make them gladly and without hesitation. This contributes greatly to accuracy and quality of cuts and assures long knife life.



## GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

**THE CLEVELAND CRANE & ENGINEERING CO.**

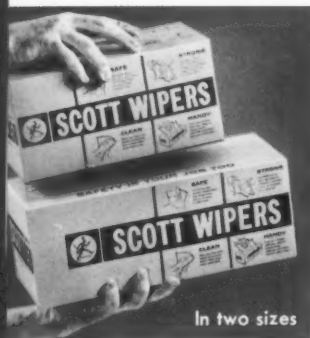
5438 EAST 282nd STREET, WICKLIFFE, OHIO

# STEELWELD PIVOTED BLADE SHEARS



To get clean wipers at the tool crib, this lathe operator must make the hike, then stand in line. Dirty wipers in hand, he makes the trip at least once a day, takes several minutes to do it.

## He has to waste 60 minutes a week

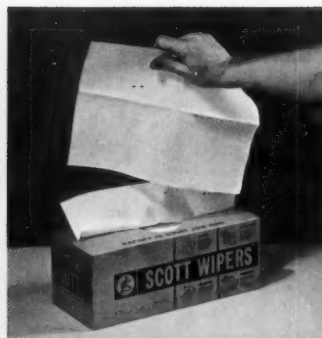


In two sizes

Easy to distribute



Really soak up oil . . .



Always a clean one handy . . .



Just toss 'em in the trash . . .





With a carton of 125 clean Scott Wipers at every workbench, daily wiper replacement is often unnecessary. One carton can last for days and a man has a fresh supply right at his fingertips.

## ... He stays on the job The difference is... Scott Wipers

Check your production line. See how much time the men are forced to waste in order to keep supplied with fresh wiping material.

It adds up to more lost production time than you might think.

Scott Wipers are disposable. A man picks up a carton when he checks in . . . keeps it with him all day long. He uses one Wiper thoroughly—throws it away. Compli-

cated distribution is ended. So is sorting, baling, and laundering.

And with fresh Scott Wipers there's no danger of hidden chips damaging men or metal.

Your local Scott representative or distributor will demonstrate the Scott Wiper in your plant. Call him or mail this coupon today.

*Another quality product of . . .*

**SCOTT PAPER COMPANY**

Scott Paper Company  
Dept. W-3, Chester, Pa.

Please send me more  
information about  
Scott Wipers.

Name

Company

Position

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**Easy to Operate  
Easy to Read**

# **Versa-Dial®**



The **ONE** truly **ALL-PURPOSE** Dial Gage

This Versa-Dial is fitted with fingers to measure I.D. of grooves. Other fingers are stocked for various lengths of reach and for small I.D.'s. Contact tips can be finished for O-rings, snap rings or specials, as required.

Equipped with other kinds of fingers, Versa-Dial can check your internal or external **THREADS** for assembly quality, shallow **COUNTERBORES** for I.D., **GEARS** for pitch diameter, **DOVETAILS** and a host of **SPECIAL SHAPES**.

*Write for details and prices to meet your specific needs*

**STANDARD GAGE COMPANY, INC.**

**MEASURING INSTRUMENTS FOR PRECISION INDUSTRY**

**122 PARKER AVE.**

**POUGHKEEPSIE, N. Y.**





# How UNITED ENGINEERING AND FOUNDRY COMPANY reduces their cost savings opportunities to careful analysis

Statement  
from

UNITED  
ENGINEERING  
AND FOUNDRY  
COMPANY

"The United Engineering and Foundry Company endorses the M.A.P.I. statement: 'Without a good analytical technique for individual replacement situations, no amount of system and organization can produce satisfactory results.'"

## EXHIBIT 'B' U.E. & F.DRY. Co. EQUIPMENT REPLACEMENT ANALYSIS

DATE 1/16/52

EST. No.	PRESENT	PROPOSED
MACH. No.	40"	25" centers
1-DESCRIPTION 54"		
23'-2" centers		\$60,000
2-SALVAGE VALUE	\$3500.00	12 years
3-AGE Built 1896-United bought 1911	41 years	12,000
4-EQUIPMENT	No. 200	SERVICE LIFE
5-DEPARTMENT	2	ESTD SALVAGE VALUE
ADVERSE MINIMA		SALVAGE RATIO
6-OPERATING IMPROVEMENT	8,647.00	TOTAL COST INSTALLED
7-LOSS SALVAGE VALUE YEAR	500.00	CHART %
8-INTEREST-SALVAGE VALUE %	245.00	INTEREST %
9-PROPORTION-CAPITAL ADDITION	1600.00	TOTAL %
10-INTEREST -	1112.00	
11-ADVERSE MINIMUM	11,904.00 (A)	ADVERSE MINIMUM
12-GAIN FROM REPLACEMENT	(NEXT YEAR) (A-B) 2,144.00	
OPERATING ADVANTAGE (NEXT YEAR)		PROPOSED
PRESENT		\$501.00
INCOME ADVANTAGES		8268.00
13-SUPERIORITY OF PRODUCT		312.00
14-INCREASED OUTPUT 30% (52x5x20x30)--1560 hours		208.00
15-OTHERS		104.00
COST ADVANTAGES		156.00
16-DIRECT LABOR 160-12 rate variation		31.00
17-INDIRECT LABOR (INSPECTION-SUPERVISION)		
18-FRINGS BENEFIT COSTS-20%	200.00	
19-MAINTENANCE		130.00
20-SUPPLIES		
21-TOOLS	150.00	
22-SPOLAGE	1120.00	208.00
23-DOWN TIME		
24-FLOOR SPACE	1470.00 (C)	2,912.00 (D)
25-POWER	8,647.00 (to line 6)	
26-PROPERTY TAXES-INSURANCE		
27-OTHERS - Adjustment on rules		
28-		
29-NET OPERATING ADVANTAGE (D-C)		

### REMARKS

RECOMMENDATIONS

SIGNED *H. H. C. C.*

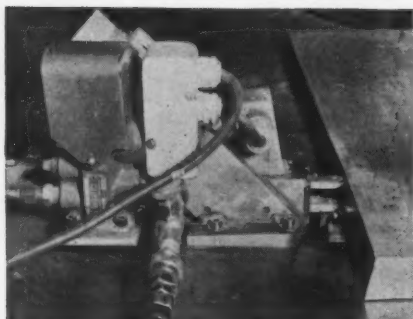
DATE *Jan 16, 1952*

APPROVED

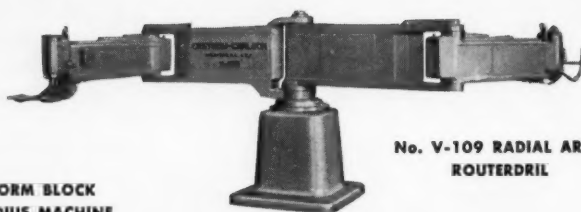
DATE

Keep gathering metal-working  
production ideas... be well  
informed when you replace  
machinery . . . . .

ROCKFORD  
INSERT  
GROUP



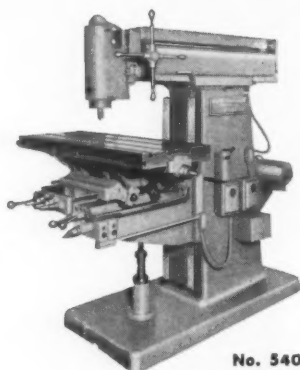
**FORM BLOCK  
RADIUS MACHINE**



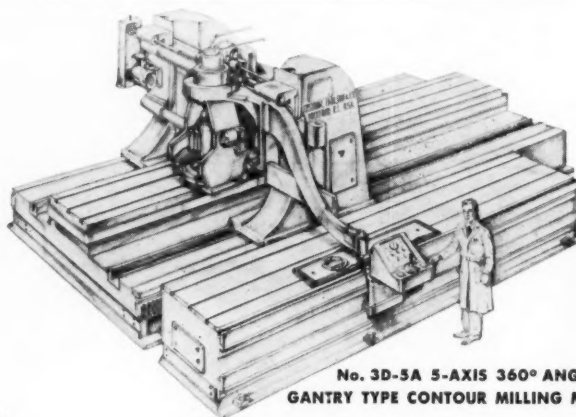
**No. V-109 RADIAL ARM  
ROUTERDRILL**

## **FOR GREATER AIRCRAFT PRODUCTION!**

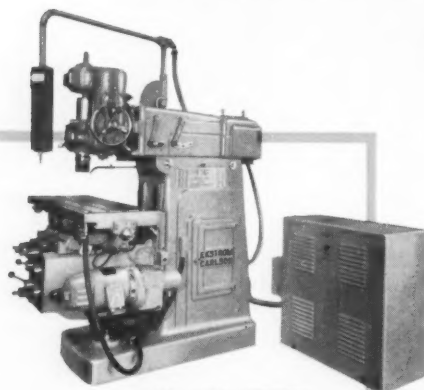
New concepts—new designs—new mechanisms—new highs in production capacities—new standards of performance . . . these outstanding attributes are typical of Ekstrom, Carlson & Co. products for the aircraft industry! Look over the many items shown here—pick out those that may fit your present and future plans—then write for free literature giving full and interesting information.



**No. 540-HC  
HI-CYCLE UNIVERSAL ROUTERMIL**



**No. 3D-5A 5-AXIS 360° ANGLE  
GANTRY TYPE CONTOUR MILLING MACHINE**

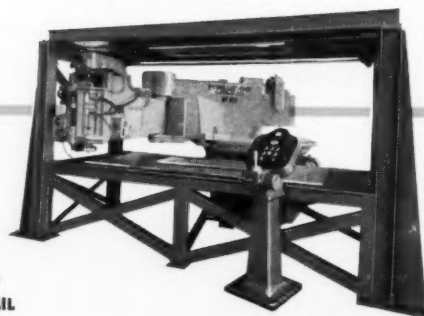


**No. 5VA VERTIMIL**

## **MACHINES**



**Write for More  
Information**



**No. 400  
CAV-RO-MIL**

**EKSTROM, CARLSON & CO., DEPT. M-4, 1400 RAILROAD AVE., ROCKFORD, ILL.**



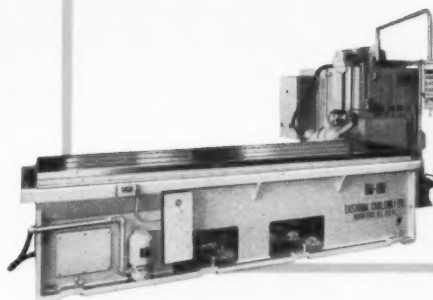
Machinery, July, 1956

**MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.**

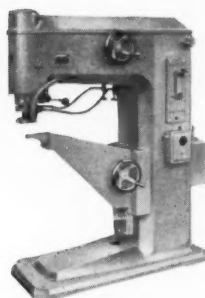




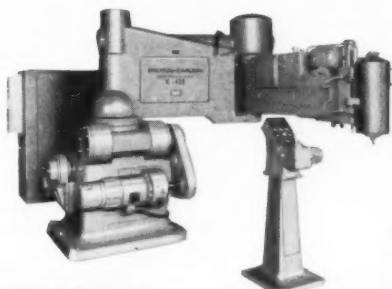
No. 71C-DS  
2-SPINDLE RADIAL ARM DRILL



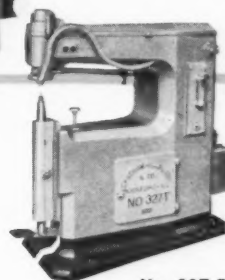
No. 5M-100  
SCARF AND EDGE  
MILLING MACHINE



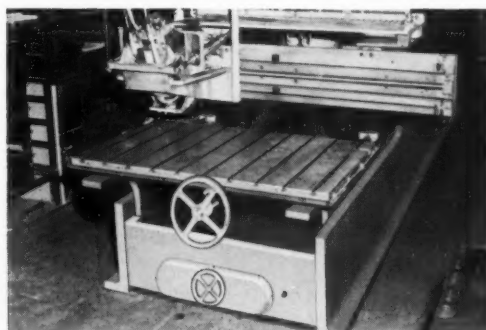
No. 434-H HORN ROUTER



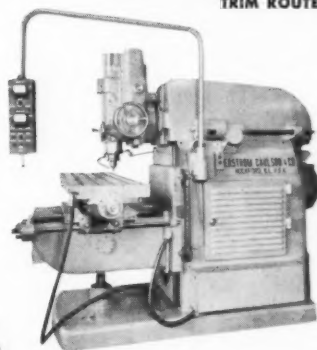
No. E-121  
ALL-ELECTRIC  
CONTOUR ROUTER



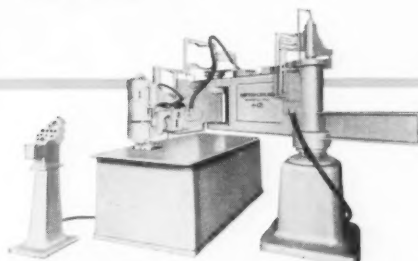
No. 327-T  
TRIM ROUTER



CONTOUR AND BEVEL ROUTER



No. 6-E VARI-SPEED  
VARI-FEED COMPOUND  
VERTICAL MILL



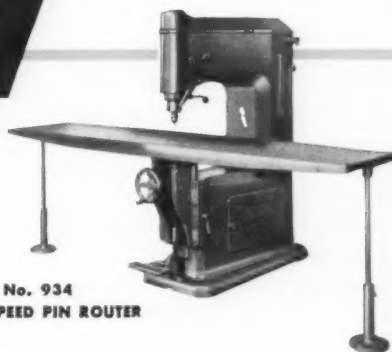
No. H-121  
HYDRAULIC-ELECTRIC CONTOUR ROUTER

and **TOOLS**

by **EKSTROM, CARLSON**



SPIRAL FLUTE ROUTER BITS



No. 934  
HIGH SPEED PIN ROUTER

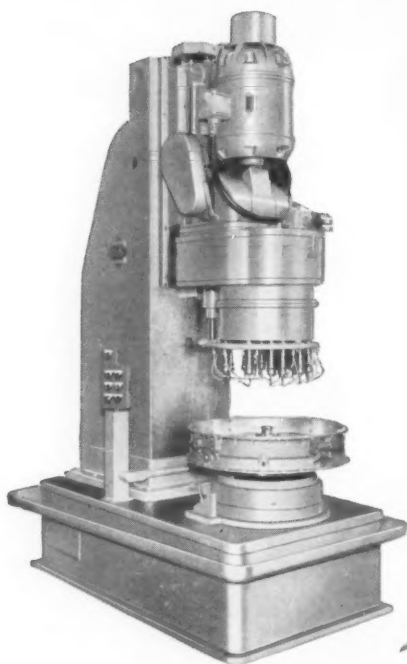
Machinery, July, 1956

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



# REHNBERG-JACOBSON

## CREATES SPECIAL MACHINES FOR SPECIAL AIRCRAFT PROBLEMS



The manufacture of aircraft, and particularly of jet engines, has introduced numerous new production problems in recent years. The solution of these problems has in many instances been accomplished by the designers and builders of special machine tools. Among such tool-manufacturers, Rehnberg-Jacobson has earned a significant position through the delivery of a wide variety of interesting and effective production machines. The principles that are characteristic of R-J products—standardized drill, tap, and index units combined with efficient tooling on an uncomplicated structure—are found to be highly successful in adaptations to the aircraft industry. Details of specific examples will be furnished on request . . .

### COSTS REDUCED BY PRODUCTION GAINS

Two examples of R-J machines for making jet engine parts are shown here. In both cases, increased production per unit time reduced the cost of the parts materially and provided an excellent return on the investment in the machines. The machine shown above, together with a companion machine, taps 73 holes in a magnesium compressor frame at the rate of 15 pieces per hour. The machine at the right automatically drills and reams 60-5/16" holes on a 34 1/2" bolt circle in a 3/4" steel stator blade adjusting spacer.



REHNBERG-JACOBSON  
MANUFACTURING CO.  
ROCKFORD, ILLINOIS



DESIGNERS, ENGINEERS  
MANUFACTURERS AND  
PRODUCTION CONSULTANTS



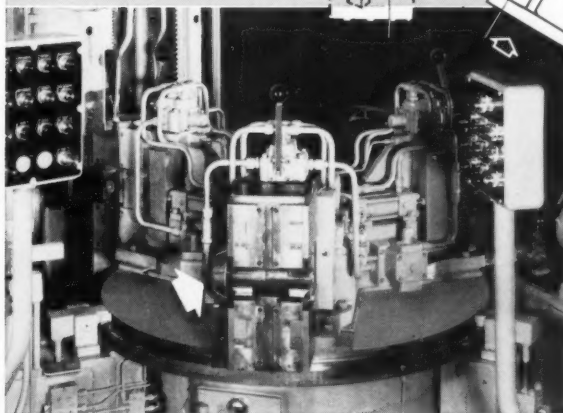
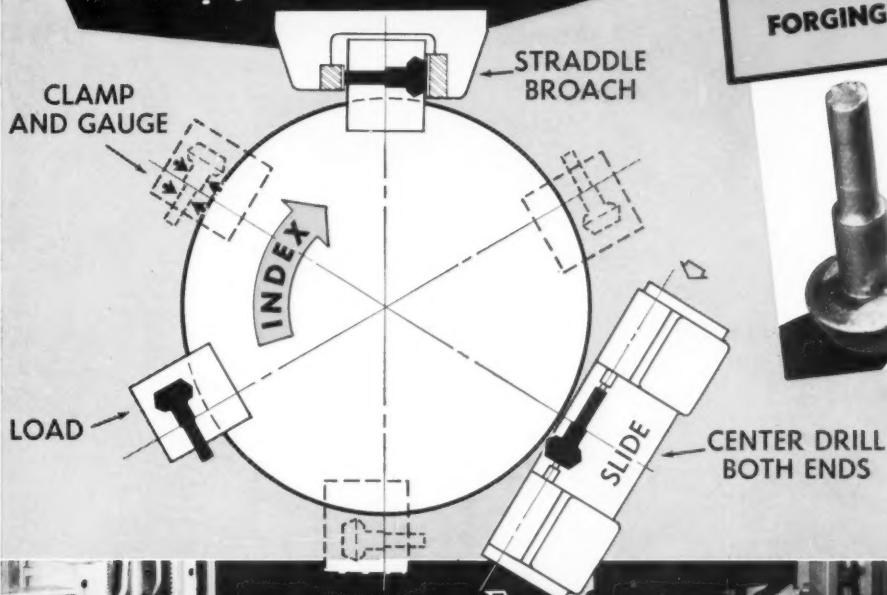
Machinery, July, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

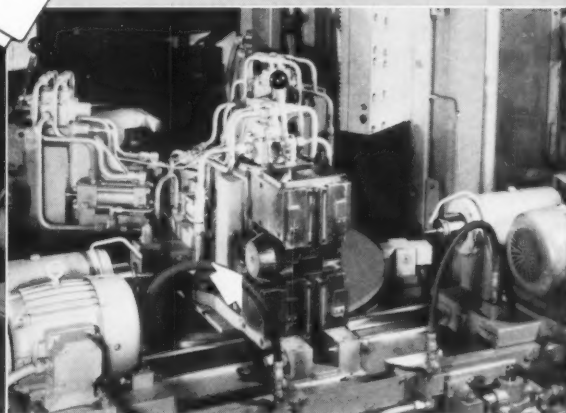
ROCKFORD, ILLINOIS, U.S.A.

ANOTHER *American* FIRST

**DIAL-INDEX, BROACH  
AND CENTER MACHINE  
FINISHES 2 ENDS OF PINION**  
... 170 parts per hour



Automotive pinion forgings are loaded at this, the first of six stations on a dial-type indexing unit. At the next station, part is automatically clamped and gauged — oversize parts stop the cycle. At the third station, both ends of pinion are straddle broached.



While one part is being broached, both ends of another part are being center drilled at the station shown here. Broaching, drilling and dial indexing are interlocked and completely automatic. Operator has time to unload and reload fixtures as they index to him.



*American* BROACH & MACHINE CO.  
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

**American Building - Ann Arbor, Michigan**

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Write or 'phone details of your broaching requirements. Or write for Catalog 450.



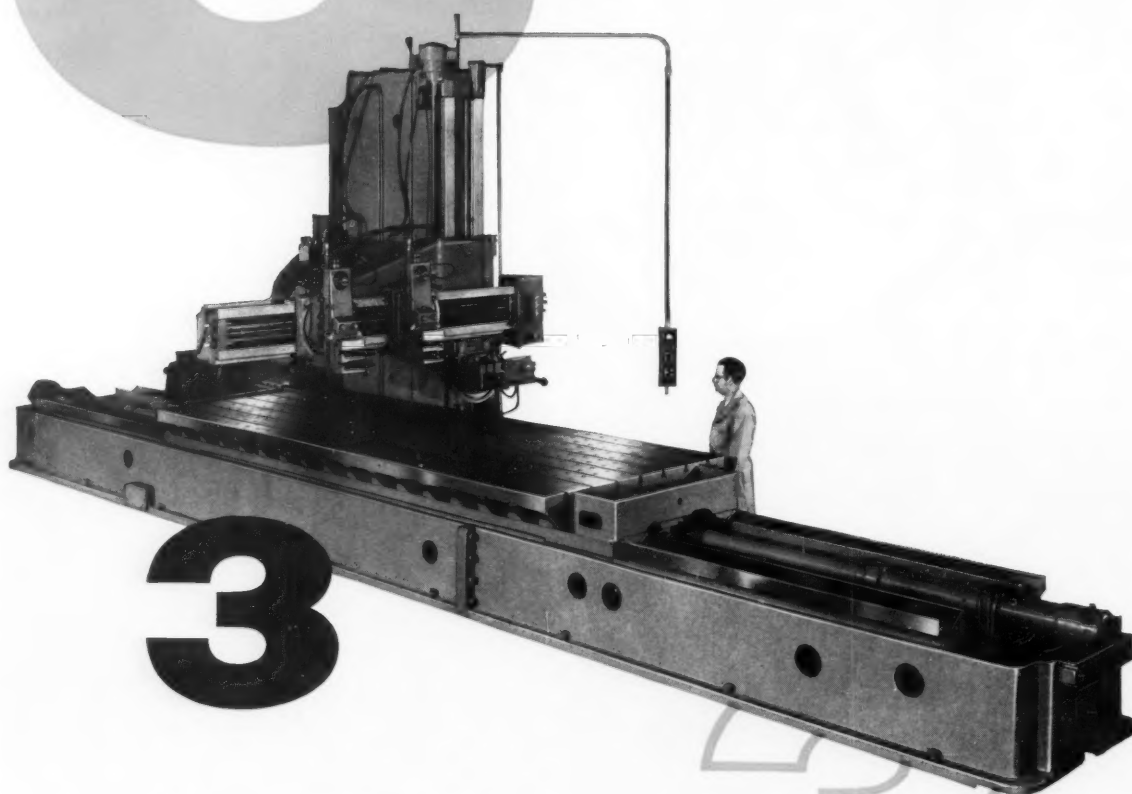
Machinery, July, 1956

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



3

planers in one machine



3

Pendant control of range and cutting  
speed selection.

Maximum return speed regardless of  
cutting speed.

Quick reversals with minimum overtravel.



Machinery, July, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

**ROCKFORD, ILLINOIS, U.S.A.**

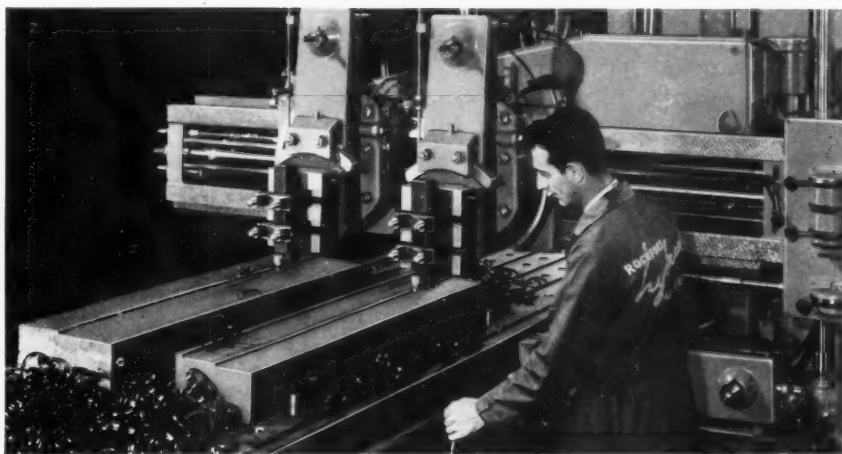


**with hydraulic triple circuit**

## **h3 drive**

low speeds to 100 fpm. with force for heavy cuts  
medium speeds to 150 fpm. with force for normal cuts  
high speeds to 300 fpm. with force for light cuts

H3 drive is an exclusive new feature on Rockford Hydraulic Planers. In the three speed circuit, a double acting cylinder opposed by a single acting cylinder are employed, giving three speed ranges with the power inversely proportional. The hydraulic triple circuit provides the correct speed and force—in one machine—to most economically machine every type of metal. Ask a Rockford Machine Tool Co. representative for further information, or write direct.



**ROCKFORD MACHINE TOOL CO.**  
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

**h3  
drive**

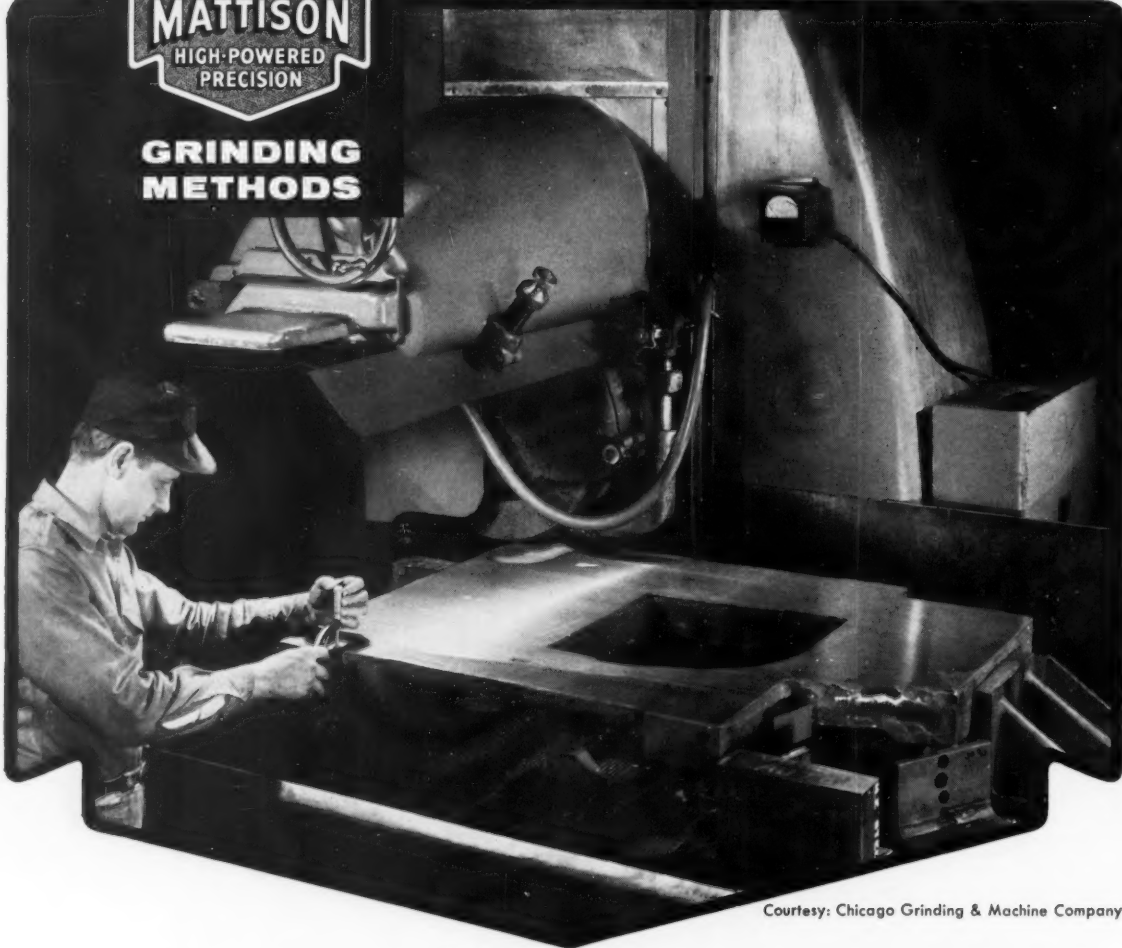
Machinery, July, 1956

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**





## GRINDING METHODS



Courtesy: Chicago Grinding & Machine Company

### How versatile skills of "Mattison-Equipped" subcontract shops can help you!



Production of precision oil seal rings is 100 per hour. Depth of countersink must be held within close limits.

Chicago Grinding and Machine Company, Chicago, Illinois, is one of hundreds of small plants using Mattison Surface Grinders for precision machining of subcontract parts. Starting with their first "Mattison" in 1939, this company now has three No. 36 Vertical Spindle Rotary Surface Grinders and one High-Powered Horizontal Grinder—machines which permit handling diversified operations accurately and fast.

Jobs illustrated here prove the unusual versatility of Mattison Surface Grinders—versatility resulting from extra-heavy construction, high power, and simplicity of adjustments.

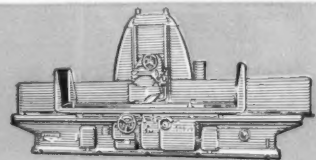
Large machine ends, above, are

ground top and bottom in six hours, each, removing  $\frac{1}{2}$  in. stock. Parallelism over 47 in. dimension is held within .0015 in. Flatness and size are held within .005 in. Massive, double-column construction permits operator to "hog off" stock with maximum efficiency.

At the left, the "No. 36" grinds two sides of precision retainer rings at the rate of 100 per hour, holding size to plus .000 minus .003 in. Power and rigidity permit grinding these parts accurately, at a high rate of production.

Hundreds of "Mattison-equipped" subcontract shops like this one can put their special grinding skills to work solving your "trouble" jobs.

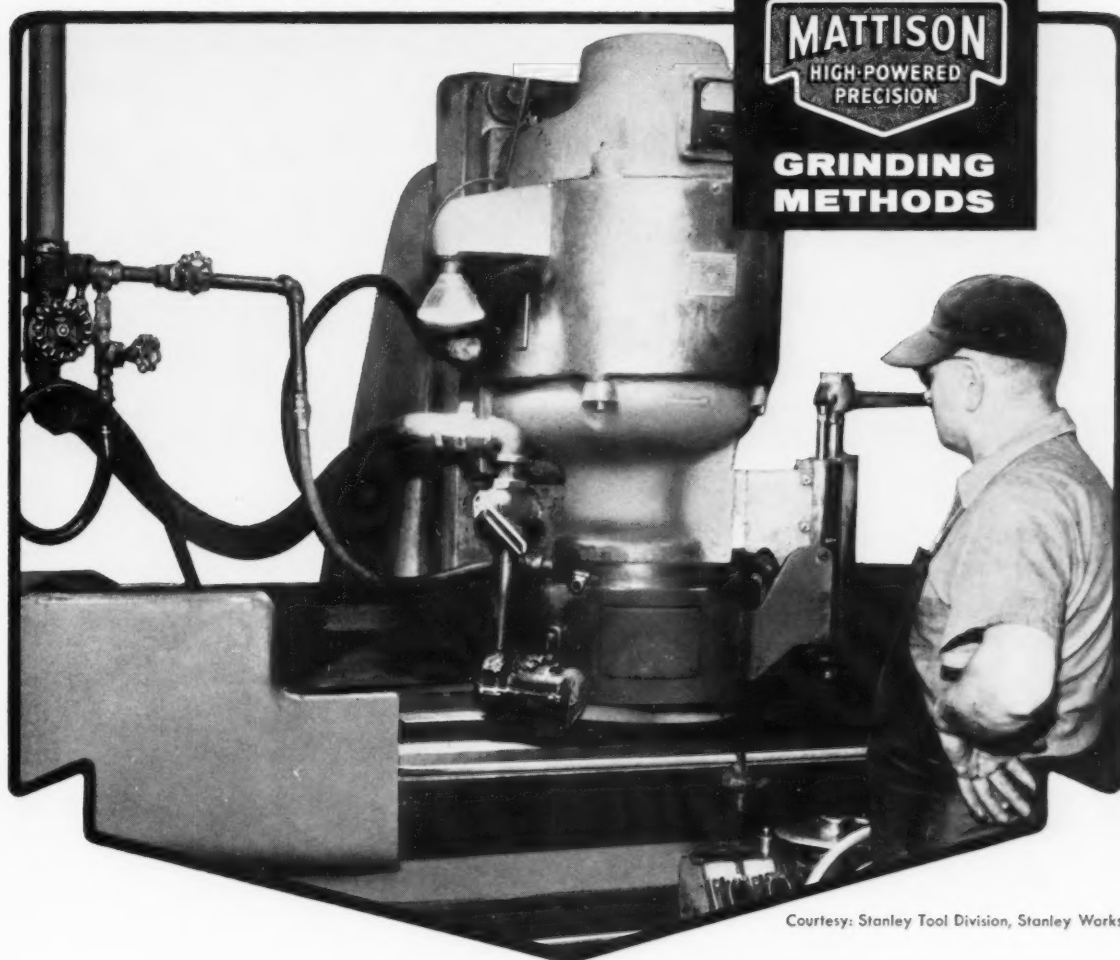
IF IT'S A FLAT SURFACE  
THERE IS A MATTISON  
TO GRIND IT



Machinery, July, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.



Courtesy: Stanley Tool Division, Stanley Works

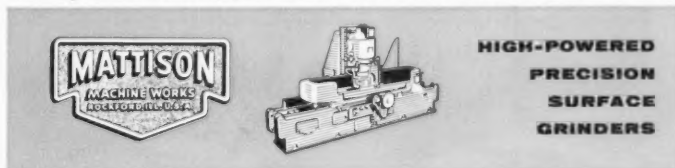
## Slash setup time and machine time, cut wheel costs on the Mattison "300"

Setup time was reduced from *nine* man-hours to one-half man-hour... and now four machines do the work of eight at Stanley Tool Division, New Britain, Conn.—results attributable to the installation of Mattison High-Powered Precision Surface Grinders.

Hardened blades for carpenter planes are ground on the Mattison "No. 300" at a rate of 1750 per hour... with a definite increase in accuracy... drastic reduction in maintenance costs... and valuable savings in wheel costs.

Perhaps you are machining flat surfaces by other methods, parts which

can be done faster, at lower cost on a surface grinder? Why not investigate Mattison's line of Vertical Spindle Surface Grinders. These machines are designed for heavy stock removal and accurate generation of flat surfaces. They permit fine increment feeds and close limits of accuracy because the wide, extra-heavy vertical column is one solid piece, bolted to the base. "Power designed" for profitable production, they permit you to machine many parts on a surface grinder that may now be produced by slower and costlier methods. Send for Bulletin No. 847.



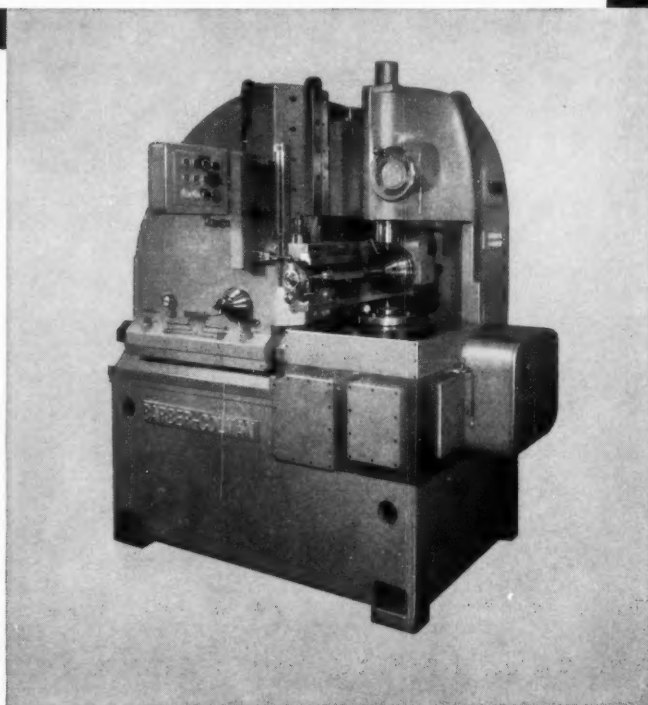
Stock removal from high carbon steel blades is .012 in. per side... production is 14,000 finished pieces per day.



**a new concept of gear accuracy!**

*Barber • Colman Builds World's Most Accurate  
Hobbing Machine* \*

\* **First**  
**hobbing machine**  
**ever guaranteed**  
**to cut gears**  
**within 10 seconds**  
**angular error**

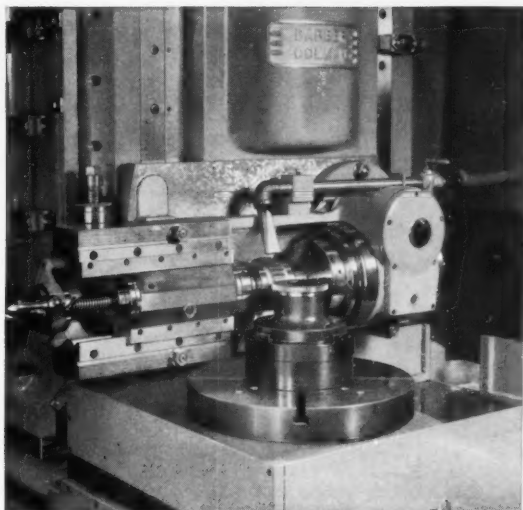


Machinery, July, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

**ROCKFORD, ILLINOIS, U.S.A.**





Barber-Colman has designed and built, in collaboration with Sperry Gyroscope engineers, a new type of hobbing machine which hobs without any further finishing operation, gears for the most accurate radar, navigational and computing equipment. This machine is known as the "Ultracision" Hobbing Machine and is so accurate that gears cut by it will transmit motion within 10 seconds of true angular rotation. This is equivalent to .0001" on 4" diameter, which is the only size that has been thoroughly investigated at the present time. This means that the combination of lead, profile and spacing errors measured over non-adjacent teeth cannot exceed 10 seconds of true angular displacement at any diameter along the involute.

In order to arrive at this degree of precision, it has been necessary to provide new methods of positively checking such accuracy. Sperry engineers utilize theodolites and auto-collimators in conjunction with pneumatic, electronic and mechanical gaging equipment which assures accurate measurement within millionths of an inch.

#### **the machine**

To produce gears of this accuracy, many new and unusual features have been incorporated in the hobbing machine. The greatest care in manufacture and assembly has been used for all parts. All vital surfaces on the machine are scraped within .0001" per foot, and even the covers are scraped to fit the scraped portions of the bed casting to prevent entry of foreign matter.

## **BARBER-COLMAN COMPANY**

627 ROCK STREET • ROCKFORD, ILLINOIS

*Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines*

Since the machine is designed to cut only spur gears, the feed drive is independent of the main drive. Capacity of the machine is 10" diameter blanks, 6" maximum length of hob carriage travel, and maximum rated pitch capacity of 32 DP. Drives to the work and hob spindles have been made as short as possible to minimize any twisting and vibration. An extremely accurate index worm and gear are mounted in ultra-precision taper roller bearings. Except for the index change gears, the gear train between the main drive shaft and the index worm contains only a worm and worm gear, and a pair of 90° helical gears.

The basic machine weighs 11,000 lbs., (with controls 13,800 lbs.) to provide the rigidity necessary for this exceptional accuracy. Another feature for increased rigidity and accuracy is the elimination of a hob slide. The hob is mounted directly on an expanding arbor, and shifted on this arbor, rather than by means of a hob slide.

Adjustments are provided for trueing the hob spindle within a few millionths of an inch. Both hob spindle and outboard support are mounted in ultra-precision taper roller bearings.

#### **the hobs**

To attain extreme profile accuracy on the gear teeth, Barber-Colman also has developed a new class of hob called "Ultracision", and made to limits of .00008" lead variation in one axial pitch, and .00015" in 3 axial pitches. These limits are just half of those for Class AA hobs. These hobs are ground and have larger than standard diameters to permit a greater number of hob teeth for very fine finish on the gear tooth profiles. Wide hubs and a 2" diameter straight bore provide maximum rigidity for the hob.

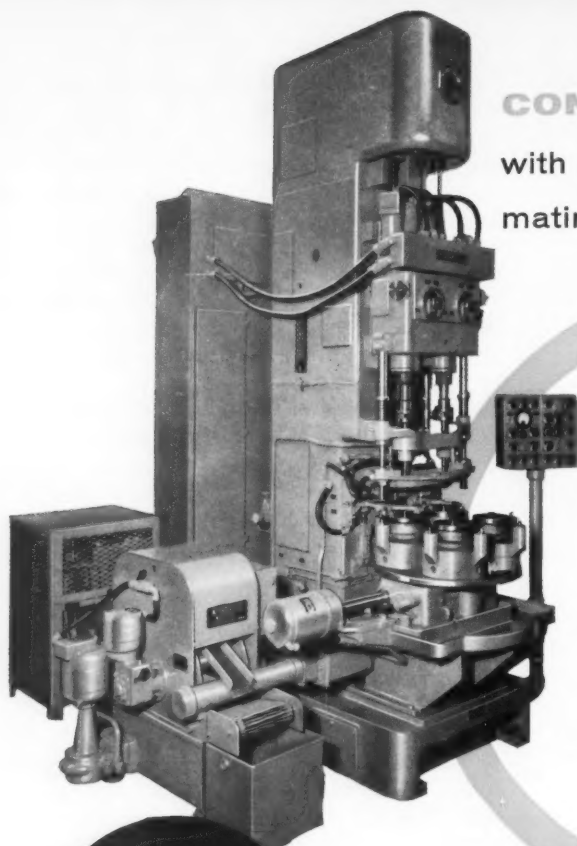
The development of this new concept in gear accuracy — the finest limits of gear accuracy ever obtained on a production basis — will eventually reflect in a higher standard of quality for gears produced on standard production hobbing machines. You are invited to submit your gear specifications and problems for analysis and recommendations by our engineers. Detailed information on the new "Ultracision" Hobbing Machine is available on request.



Machinery, July, 1956

**FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.**





## CONTROL PARTS INVENTORY

with guaranteed **single-size**  
mating parts

Barnesdril  
honing control  
eliminates size  
differences (tenths)  
between bores;

**guarantees**  
**one-size**  
**finishing**



Barnesdril honing machines with controlled sizing automatically establish positive limits on cylinder bores, connecting rods, gears and other mating parts. Because single size is guaranteed bore-to-bore through Plugmatic Sizing, production of mating parts is simplified and inventory is held to a minimum.

The inherent capacity of Barnesdril Honing to hold bore tolerances precisely, and guarantee single size bore-to-bore, reduces both operating and inventory costs. Ask for production estimates on your bore finishing operations. A Barnesdril engineer will be glad to call.



New bulletin no. 550

completely describes controlled size, finish  
and accuracy with Barnesdril Honing.  
Write for a copy.

DETROIT OFFICE, 3419 South Telegraph Road, Dearborn, Michigan

**BARNES DRILL CO.**



820 CHESTNUT STREET • ROCKFORD, ILLINOIS



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

YOU GET A

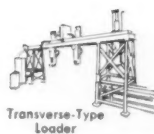
Two-Fold

## CREATIVE AUTOMATION SERVICE

AT  
**W. F. & JOHN BARNES**



Probe-Type  
Inspection Machine



Transverse-Type  
Loader



Metal Fastener  
Assembly Equipment

Now to better serve your needs and help you solve automation problems quickly, Barnes offers a two-fold coordinated service.

### COMPLETE PRODUCTION-LINE ENGINEERING

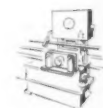
1 For new production line methods calling for either automatic or semi-automatic operations, you'll find at Barnes an experienced engineering staff to work with you. Detailed plans and proposals will be submitted for your consideration and can be depended upon to give you the latest in automation ideas and the very best of proven mechanical, hydraulic, and electrical actuation methods. Ask for a survey early in your planning program.

### DESIGNING & BUILDING SPECIALIZED UNITS

2 The second and equally important part of Barnes two-fold service is the designing and building of specialized individual units to suit your specific needs. At Barnes you'll find a coordinated service where electrical, mechanical, hydraulic, fixture and tool engineers work together as a team. The combined efforts of a highly skilled and experienced engineering staff, coordinated with complete manufacturing facilities, help you save time by eliminating divided responsibility.

### ASK FOR A METHODS ANALYSIS

Find out today why more and more Production Executives are turning to Barnes for a practical solution to their automation problems. We will be pleased to analyze your requirements, offer recommendations, and submit a cost estimate in a formal proposal if you so desire.



Casting Automatic  
Leak Test Machine



Automatic  
Roll-Over Unit

Builders of Better  
Machines and  
Equipment since  
1872



### AUTOMATION SECTION

416 S. WATER ST.

• ROCKFORD, ILLINOIS

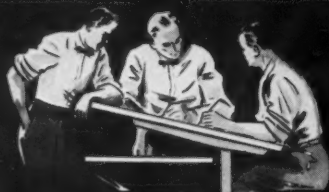
SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL  
PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

Machinery, July, 1956

FOR PRODUCTION MACHINE TOOLS IT'S

**ROCKFORD, ILLINOIS, U.S.A.**





### DESIGN ENGINEERS

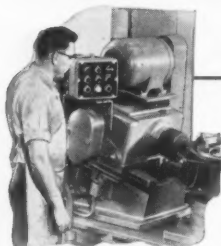
SUNDSTRAND design engineers devote their time to the design and development of basic standard units which can be used in many combinations of either standard or special machines. They are primarily concerned with the functioning of the individual components which go into a machine.

Their design experience is based on many years of development of units for light fast cutting on small parts, heavy cuts on large parts, three dimensional tracing of irregularly shaped work pieces and countless other problems in milling.

Some of the units developed are shown below. From these basic elements it's easy to get what you need from Sundstrand.

# How Two Types of Engineers Serve You With SUNDSTRAND

*"Engineered Production"*

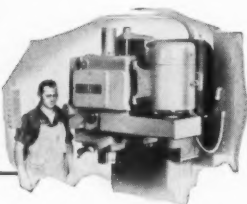


### VERTICAL OR HORIZONTAL HEADS

Available in capacities from 3 to 100 h.p.

### TRAVELING HEADS

Self contained units with ways for horizontal or angular travel.



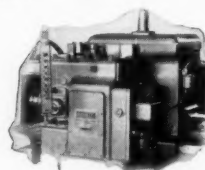
### HORIZONTAL TABLES

Available in widths from 10½" to 96" and feed strokes from 18" to 216".



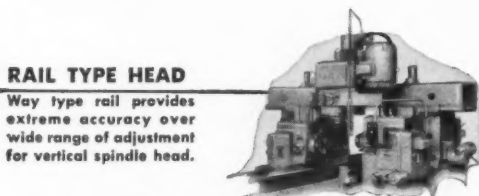
### INDEX BASES

Easily applied to standard Rigidmills for increased production by the elimination of loading time or improvement in accuracy by the machining of multiple surfaces with one handling of the work piece.



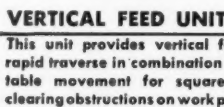
### ADJUSTABLE COLUMNS

Movable columns provide maximum cutting rigidity for horizontal heads over a wider range for milling both large and small work pieces.



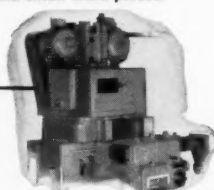
### RAIL TYPE HEAD

Way type rail provides extreme accuracy over wide range of adjustment for vertical spindle head.



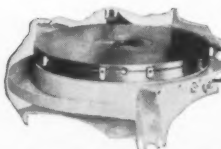
### VERTICAL FEED UNIT

This unit provides vertical feed and rapid traverse in combination with the table movement for square cycles, clearing obstructions on work piece, etc.



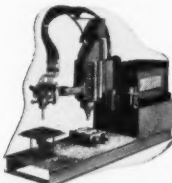
### AUTOMATIC QUILL POSITIONING

Positions the cutter for multiple depths of cuts and provides automatic cutter relief.



### ROTARY TABLES

Available in several sizes for continuous or rotary milling operations.



### TRACER MILLING UNIT

Used for 3 dimensional tracer milling of intricate forms.

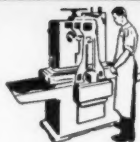
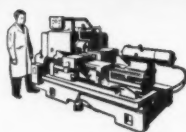
SUNDSTRAND

*"Engineered Production Service"*  
\*REG. U.S. PAT. OFF.

AUTOMATIC LATHES

SIMPLEX RIGIDMILLS

DUPLEX RIGIDMILLS

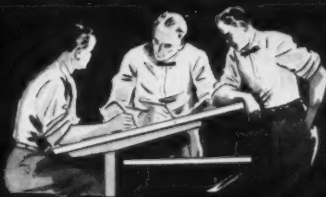


Machinery, July, 1956

MACHINES DESIGNED TO MEET YOUR NEEDS

ROCKFORD, ILLINOIS, U.S.A.





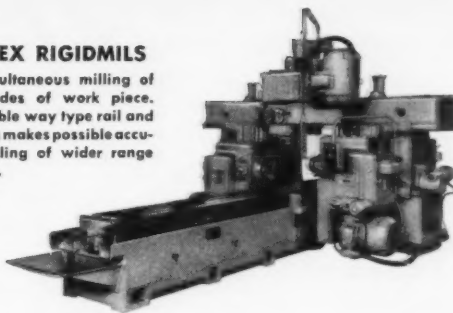
### APPLICATION ENGINEERS

In effect, our application engineers increase both the size and experience of your own processing department when you refer your milling problems to Sundstrand. They place at your disposal all the broad background of knowledge accumulated thru many years of finding the best method and then providing the most suitable unit or machine combination to do the job.

Shown below are just a few of the many machine combinations available from Sundstrand units. With this method of machine design and construction it is easy to obtain the proper equipment to suit your work.

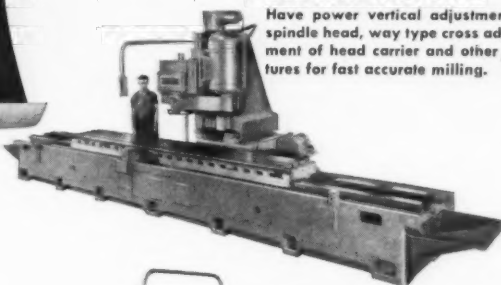
### TRIPLEX RIGIDMILS

For simultaneous milling of three sides of work piece. Adjustable way type rail and columns makes possible accurate milling of wider range of work.



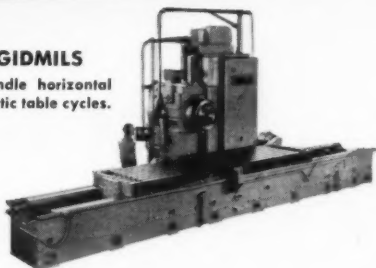
### VERTICAL RIGIDMILS

Have power vertical adjustment to spindle head, way type cross adjustment of head carrier and other features for fast accurate milling.



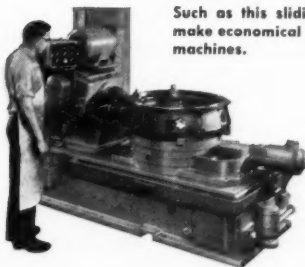
### SIMPLEX RIGIDMILS

Have single spindle horizontal head and automatic table cycles.



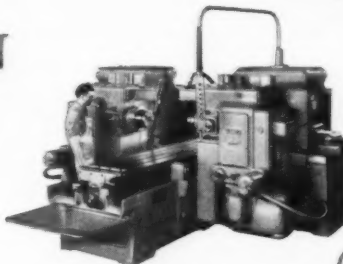
### UNIT TYPE RIGIDMILS

Such as this sliding head machine make economical special production machines.



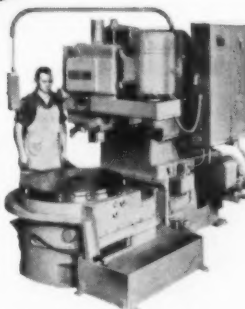
### DUPLEX RIGIDMILS

Have two horizontal heads for milling two sides simultaneously. Adjustable column type shown has wider range between spindles.



### ROTARY RIGIDMILS

Have vertical spindle head, way type cross adjustment of spindle head carrier and rotary table for continuous or circular milling.

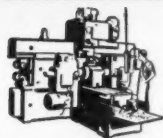


### FREE DATA

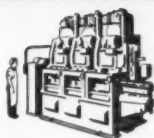
Get complete facts on the complete line of Sundstrand machine tools and "Engineered Production" service. Write for Bulletin 669.



### TRIPLEX RIGIDMILS



### SPECIAL MACHINES



## SUNDSTRAND Machine Tool Co.

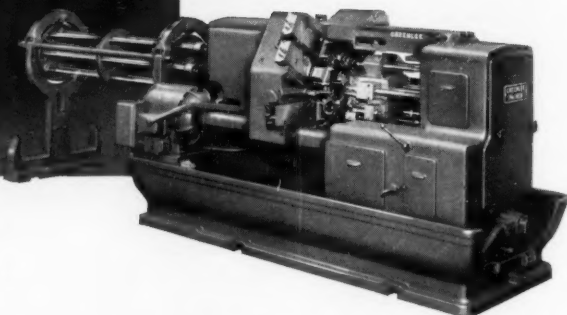
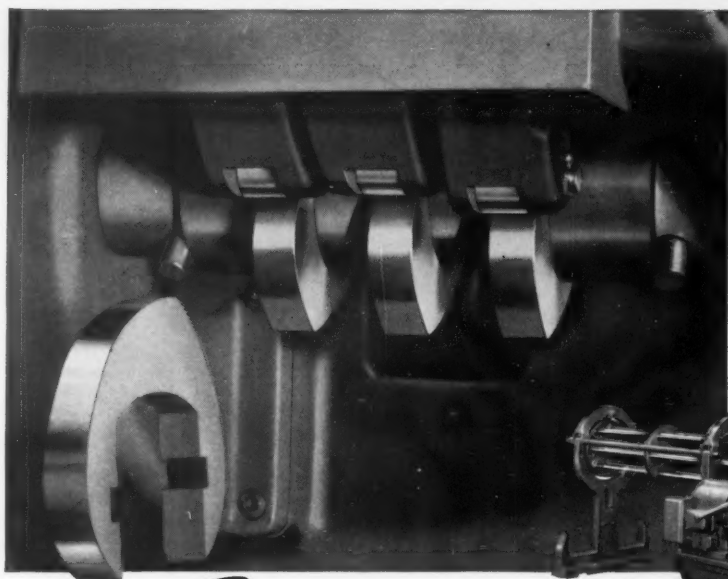
2530 Eleventh St. • Rockford, Ill., U.S.A.

Machinery, July, 1956

CITY OF MACHINE-TOOL SPECIALISTS

ROCKFORD, ILLINOIS, U.S.A.





# *Simplified* **CROSS-SLIDE CAMMING** **ON GREENLEE BAR AUTOMATICS**

*Gives You Greater Flexibility... Saves Setup Time*

**CAMS ARE INTERCHANGEABLE**

**CAMS ARE SMALL, EASY TO HANDLE**

**CAMS HAVE UNIFORM HIGH-POINT**

Greenlee simplified camming results in simplified, fast setups. Operation is economical and efficient . . . especially so on short runs. Each cross slide operates independently by a separate cam . . . long operations are easily split up for greater flexibility and more effective use of machining time. On a Greenlee your investment in cams is held at a minimum . . . the same cams can be used on any cross slide. Greenlee engineers will be glad to show you how to reduce profit-stealing setup time on the simplified Greenlee. Take advantage of this valuable service now.



Do you receive a copy of the Greenlee "Automatic News" regularly? If not, write and ask to be placed on our mailing list. Give company name and job responsibility.

**WRITE TODAY FOR CATALOG A-405**



**GREENLEE BROS. & CO.**  
1869 Mason Avenue  
Rockford, Illinois



Machinery, July, 1956

**MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.**



## compare with the standard ...in high speed steels the standard's **REX**

Ever since grandad's day, Crucible's REX® high speed steel has been *the standard by which all other high speed steels are compared*. And now the quality and uniformity of REX are even *better*, thanks to improved manufacturing techniques at Crucible.

Don't take our word for it. Prove for yourself how REX leads in structure, uniformity, response to heat treatment, and fine tool performance.

Ask for REX at your nearby Crucible warehouse — or order it through prompt mill shipments. And, for a list of available data on all Crucible special purpose steels, write now for a free copy of the "Crucible Publication Catalog". Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

# CRUCIBLE

first name in special purpose steels

## Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—99

At Scully-Jones and Co., Chicago:

## MACHINING COSTS GREATLY REDUCED



Here's how the Carboloy Machinability Computer showed Scully-Jones and Co., Chicago, how to reduce machining time 46% on a single job. Original operating standard for machining expanding shells called for 244 minutes per part. But by calculating the

optimum combination of speeds, feeds, and other data on the Computer, the company saved 48.8 minutes per part. The Computer was used to determine setups for both HSS and carbide tools . . . on turning, facing, drilling, and boring operations.

### Partial list of plants now using the Carboloy Machinability Computer:

Allied Products Corp.  
Armstrong Cork Company  
Beech Aircraft Corp.  
Bendix Aviation Corporation  
Ulrica Division  
Bethlehem Steel Company, Inc.  
Boeing Airplane Company  
Bryant Chucking Grinder Co.  
Burroughs Corporation  
Caterpillar Tractor Company  
Chrysler Corp.  
Airtemp Division  
The Cincinnati Shaper Co.  
Cone Automatic Machine Co., Inc.

DeLaval Steam Turbine Co.  
The DoAll Co.  
Fuller Company  
General Electric Company  
Gisholt Machine Company  
Goulds Pumps Inc.  
Greenfield Tap and Die Corporation  
Geometric Tool Company Division  
Greenlee Bros. & Co.  
Houdaille Industries, Inc.  
Buffalo Hydraulics Division  
Joy Manufacturing Company  
Claremont Division

Ladish Co.  
The Maytag Company  
Mergenthaler Linotype Company  
Miehle Printing Press & Mfg. Co.  
Mueller Brass Co.  
The National Acme Company  
The New Britain Machine Co.  
New Britain-Gridley Machine Division  
Pachmayr Corp.  
Porter-Cable Machine Company  
Reed Roller Bit Co.  
Cleco Air Tools Division

The R. K. LeBlond Machine Tool Co.  
Rockwell Spring & Axle Co.  
Blood Brothers Machine Division  
Ryan Aeronautical Company  
S. Morgan Smith Co.  
Standard Pressed Steel Co.  
Sundstrand Aviation  
A Division of Sundstrand Machine Tool Co.  
Thompson Products, Inc.  
Wagner Electric Corporation  
Westfield Metal Products Co., Inc.  
The Yale & Towne Manufacturing Co.  
Yale Materials Handling Division



# WITH CARBOLOY MACHINABILITY COMPUTER

- ▶ Determined most efficient cutting conditions
- ▶ Set up new operating standards in seconds
- ▶ Eliminated wasteful tryout runs, saved stock
- ▶ Saved 17 hours' machining time on a single job
- ▶ Provided closer control over machine downtime

Obtaining maximum production from their machines is now an easier matter for Scully-Jones and Co., Chicago. Machining data are fed into their Carboloy® Machinability Computer . . . and in seconds, optimum speeds, feeds, horsepower ratings, or any of 16 other operating variables are figured for the operator.

On the job at left, for example, the Computer showed how to cut machining time 46% on a 13-piece run . . . saving 17 machining hours, and eliminating wasteful, time-consuming tryout runs.

## Benefits extend plant-wide

On other jobs throughout the plant, the Computer established new operating standards, corrected and verified existing ones. When necessary to improve tool life or production rate, the Computer determined new operating conditions in a fraction of the time previously required.

The advantages of the Carboloy Machinability Computer extend far beyond figuring

job setups. The Computer simplified inventory problems by predicting the rate of tool wear. It aided grinding rooms in planning work loads, and helped the plant superintendent coordinate production schedules.

The Carboloy Machinability Computer can be used by anyone with machining experience, after a short familiarization period. And, it can be a powerful educational tool by teaching operators how to improve production or reduce downtime through proper variations in operating conditions.

## Ask for demonstration

The Machinability Computer is battery-operated, portable, and rugged. It is priced at \$495 (f.o.b. factory, Detroit).

For more information on how the Computer can help your plant increase production and reduce manpower costs, mail the coupon below. If you wish, we will gladly arrange a demonstration in your plant.

# CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11147 8 Mile Road, Detroit 32, Michigan

☐ Please send more information on the Carboloy Machinability Computer.

☐ Have a representative make an appointment to demonstrate the Computer.

NAME \_\_\_\_\_

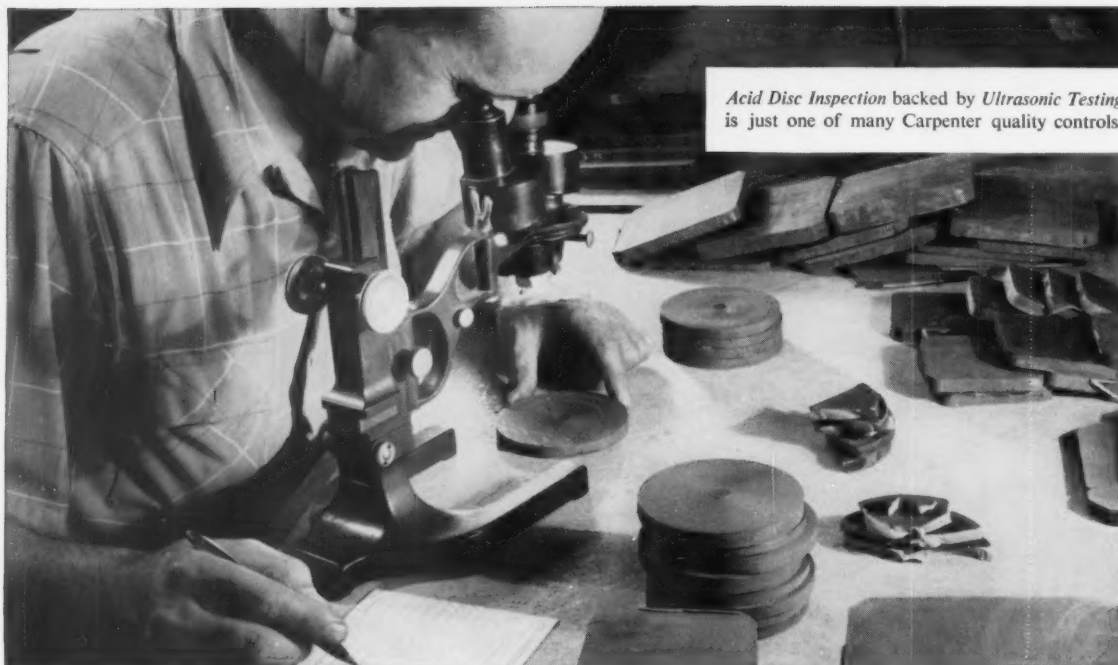
TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company



## IF YOU USE TOOL STEEL, THESE ARE FACTS YOU SHOULD KNOW

When you make or use a tool or die you invest a sizable sum of money. And there are steps you normally take to protect your investment. You make sure the design is right. You follow through with accurate tool-making and correct heat treating. But there is *one* factor involved in the success of your die, over which you have only indirect control. That factor is the *soundness* of the die steel you start with. After all, if the steel itself isn't right, you needlessly risk your entire investment.

How can you be *sure* the die steel you use has what it takes to assure good tools? The answer lies in the painstaking controls regularly practiced by the steel manufacturer. Listed here are the four important tool steel controls pioneered by Carpenter to give steel users like yourself the protection you need. Before you place that next tool steel order, ask yourself, "Does our steel supplier guarantee these four quality controls in the die steel we use?" Then remember: You can be *sure* of them when you specify Carpenter Matched Tool and Die Steels. And you don't pay anything extra! THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.

### 4 Tool and Die Steel Developments Pioneered by Carpenter Help Carpenter Customers Cut Costs, Improve Die Performance

#### Since 1929:

**HOT ACID DISC INSPECTION** has been standard practice at Carpenter. To Carpenter customers it provides full assurance that Matched Tool and Die Steels are internally sound, shipment after shipment.

#### Since 1930:

**THE TOUGH TIMBRE TEST** has assured Carpenter users a wider safe hardening range, greater dependability in performance.

#### Since 1933:

**THE TORSION IMPACT TEST** has provided Carpenter Matched Tool and Die Steel users with more complete heat treating information that leads to better tools and dies.

#### Since 1940:

**THE CONE TEST**, used to check and control hardenability of Carpenter water-hardening Matched Tool and Die Steels, has made sure that sections of the same size have uniform hardness penetration in lot after lot.

# Carpenter STEEL

Matched Tool and Die Steels

Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U.S.A. and Canada



**DO YOU NEED  
BETTER METAL CLEANERS  
FOR THESE JOBS?**



*Will you take a few seconds to check this list and circle in the coupon the numbers of the jobs on which you need better results?*

<b>1</b>	<b>Cleaning aluminum in preparation for anodizing.</b> See pages 4 to 8 in "How to clean metals in aircraft production."
<b>2</b>	<b>Cleaning and deoxidizing aluminum in preparation for spot welding.</b> See pages 10 to 14.
<b>3</b>	<b>Cleaning and conditioning aluminum in preparation for painting.</b> See pages 15 to 19.
<b>4</b>	<b>Cleaning aluminum after heat treating.</b> See page 20.
<b>5</b>	<b>Stripping paint from aluminum.</b> See pages 22 to 26.
<b>6</b>	<b>Cleaning magnesium.</b> See pages 27 to 29.
<b>7</b>	<b>Controlling overspray in paint booths.</b> See pages 36 to 37.
<b>8</b>	<b>Cleaning engine test cells.</b> See page 40.

**FREE** Write for your copy of this  
48-page illustrated booklet.

Technical Service Representatives in  
Principal Cities of U. S. and Canada

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Cable Address: Oakite



**Oakite Products, Inc., 26 Rector St., New York 6, N. Y.**

Send me a **FREE** copy of your booklet "How to clean metals in aircraft production."

I am interested in getting better results in the cleaning jobs indicated by the numbers I have circled below:

1 2 3 4 5 6 7 8

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

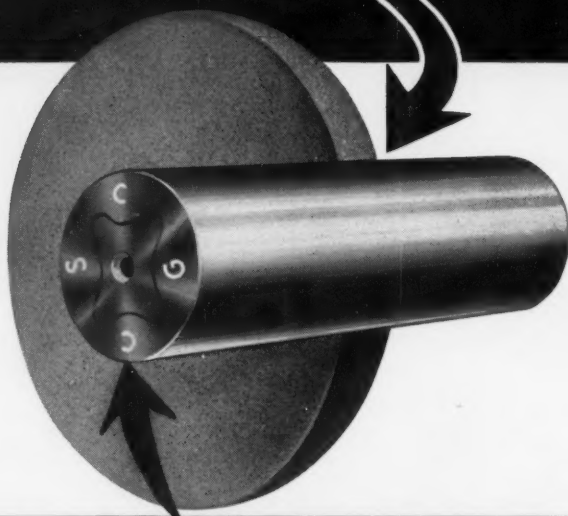
ADDRESS \_\_\_\_\_

# An exclusive GRINDING PROCESS...

makes

## CUMBERLAND STEEL BARS

concentric, straight,  
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

## CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

### MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.  
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.  
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

# CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845

INCORPORATED 1892

101A—MACHINERY, July, 1956

For more information fill in page number on Inquiry Card, on page 261





Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago

Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

## Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

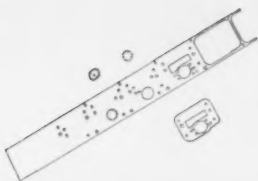
A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 13, 500 Fifth Avenue, New York 36, N. Y.

# CLIMAX MOLYBDENUM

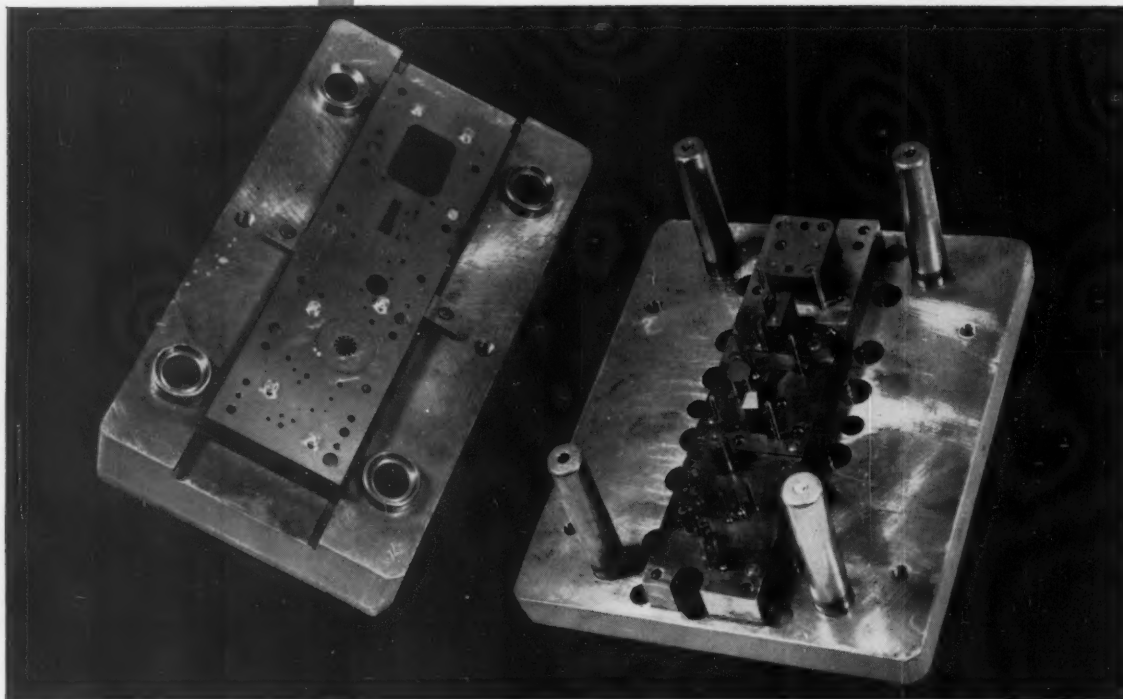


Use the  
Moly Key  
to better  
carburizing  
steels

- High case hardness
- Wide choice of hardenability
- Easy to heat treat
- Low distortion
- Good machinability
- Good wear resistance



## This **HURON** Lamination Die Gave Initial Run of **426,000!**



### Write for BLUE SHEET on HURON

This concise four-page folder gives all needed handling and shop treatment details on Huron. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. Ask for your copy.

Address Dept. M-79

LUDLUM HURON high-carbon, high-chrome die steel was the material used in this motor lamination die. Here was the result when the die was run on a 45-ton Bliss press at 210 strokes a minute:

- 1 Initial run was 426,000 pieces
- 2 Average run since has been 250,000 pieces
- 3 Although burr tolerance is .003", grinding of punch and die between runs has not exceeded .008"

LUDLUM HURON WAS SELECTED because of its known high resistance to wear, especially under heavy pressures, and its excellent non-deforming qualities. Because Huron is an oil-hardening steel and hardens uniformly to a great depth, a consistent production rate after each grind was assured.

There's an A-L Tool Steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

For complete **MODERN** Tooling, call  
**Allegheny Ludlum**



W&D 5157



## Awesome press contains longest forgings ever made

Without seeing this incredible press at close range, it is difficult to grasp its true magnitude. Only a portion of the giant apparatus is shown in the photograph. Actually, it is as tall as an eleven- or twelve-story building, but the major part of it is underground. Considerably less than half of its height is visible above the working floor.

Designed and built by Loewy-Hydropress, Division of Baldwin-Lima-Hamilton Corp., this king of machines is rated at 50,000 tons. It is installed at the Wyman-Gordon-U. S. Air Force plant, North Grafton, Mass., where it is used in the making of large airplane components. It can, for example, forge an entire aluminum wing spar with a single mighty squeeze.

Speaking of forgings, the press itself actually contains some record-breakers. Its six columns consist of the

eighteen longest forgings ever made. Eighteen identical steel sections, each with an overall length of 108 ft! All of these pieces were forged by Bethlehem in its Bethlehem, Pa., shops; so, too, were the crosshead supports, platen side rails, and certain other parts.

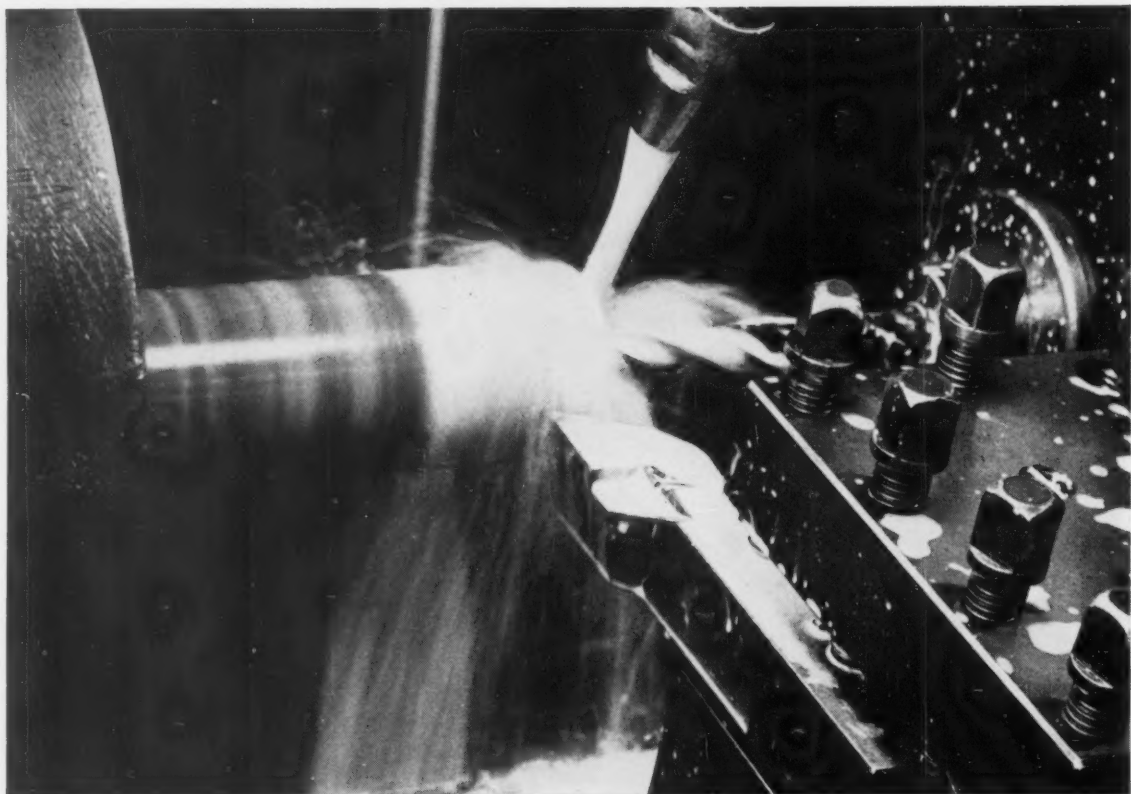
It is rare that a forge shop receives an assignment presenting such a challenge. It took months of painstaking effort to produce the column sections, but Bethlehem facilities were equal to the job. These same facilities are available to any customer who needs steel forgings. When we can be of service to you, please call or write.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation  
Export Distributor: Bethlehem Steel Export Corporation

# BETHLEHEM STEEL





## How to make your automatic machine tools even more automatic—at no extra cost

**C**ONTINUOUS production is what makes your automatic machine tools profitable. Every time you have to stop them to make an adjustment or a change in setup, you reduce their potential. This puts greater demands than ever on the uniformity of the steel you machine. And the more uniform your steel machines, the more automatic your machine tools become.

You can get the ultimate in uniformity at no extra cost by using Timken® fine alloy steel. Timken steel is uniform from bar to bar, heat to heat, order to order. Here's why:

We use the industry's first direct-reading spectrom-

eter to insure uniform grain size and to control chemical composition right up to the time each heat is tapped.

We adjust our conditioning procedure to suit your machining requirements. Your order is handled individually. Each bar is stamped to identify the heat it came from. Uniformity is constant from bar to bar and heat to heat.

To make your automatic machine tools even *more* automatic—and at no extra cost—specify Timken steel machining bars. They machine the same time after time after time after time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

103A—MACHINERY, July, 1956

For more information fill in page number on Inquiry Card, on page 261



# Giant LeTourneau Sno-Freighter built on rugged backbone of **SHELBY SEAMLESS MECHANICAL TUBING**



Another LeTourneau "train," also constructed with Shelby Seamless Mechanical Tubing, maneuvers through the streets of Longview, Texas. The uncovered control car reveals its 3,500-gallon fuel tank and its two diesel engines which generate electricity for driving the wheel motors.



Sno-Freighter in action in northern Alaska. The control cab is 17 feet high; the decks of the cargo carriers are 8½ feet high. Speeds range from 0 to 15 MPH.

The LeTourneau Sno-Freighter is a huge six-section cargo carrier specifically designed to travel over ice, frozen or compacted snow, bull-dozed trails, or rough brush land. It is presently in active use hauling fuel and other strategic materials to radar stations along the Arctic Coast.

The Sno-Freighter "train" consists of a power control car and five cargo cars, each with a capacity of 25 tons. Two 400 H.P. diesel-electric generating sets on the power control car supply electrical power to the 24 drive wheels, each of which has a powerful electric motor tucked into its rim. Thus, each wheel drives independently of the others, making it practically impossible for the carriers to get stuck in sand, snow, or swamp.

All of the Sno-Freighter's car frames are constructed of Shelby Seamless Mechanical Tubing in diameters from 2 inches to 8 inches. In addition, each of the cars is coupled to the one preceding it through a universal joint and

a long steel tube of Shelby Seamless. This constitutes the steering mechanism, causing each vehicle automatically to track the car ahead of it. The operator of the Sno-Freighter steers only the two front wheels of the power control car.

There are many good reasons why Shelby Seamless Mechanical Tubing was chosen for the supporting framework of this magnificent mechanical marvel. Primarily, it offers the ultimate in strength and rigidity in proportion to its size and weight. Secondly, it is shock-absorbent, uniform throughout, dimensionally accurate, and possesses excellent machining and superior welding properties. It is produced under rigid standards, and is available in a generous range of diameters, wall thicknesses, various shapes and steel analyses. And it can be fitted to your specifications, regardless of what they are. Contact our engineers. They will be happy to help you adapt Shelby Seamless to your requirements.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

(Tubing Specialties)

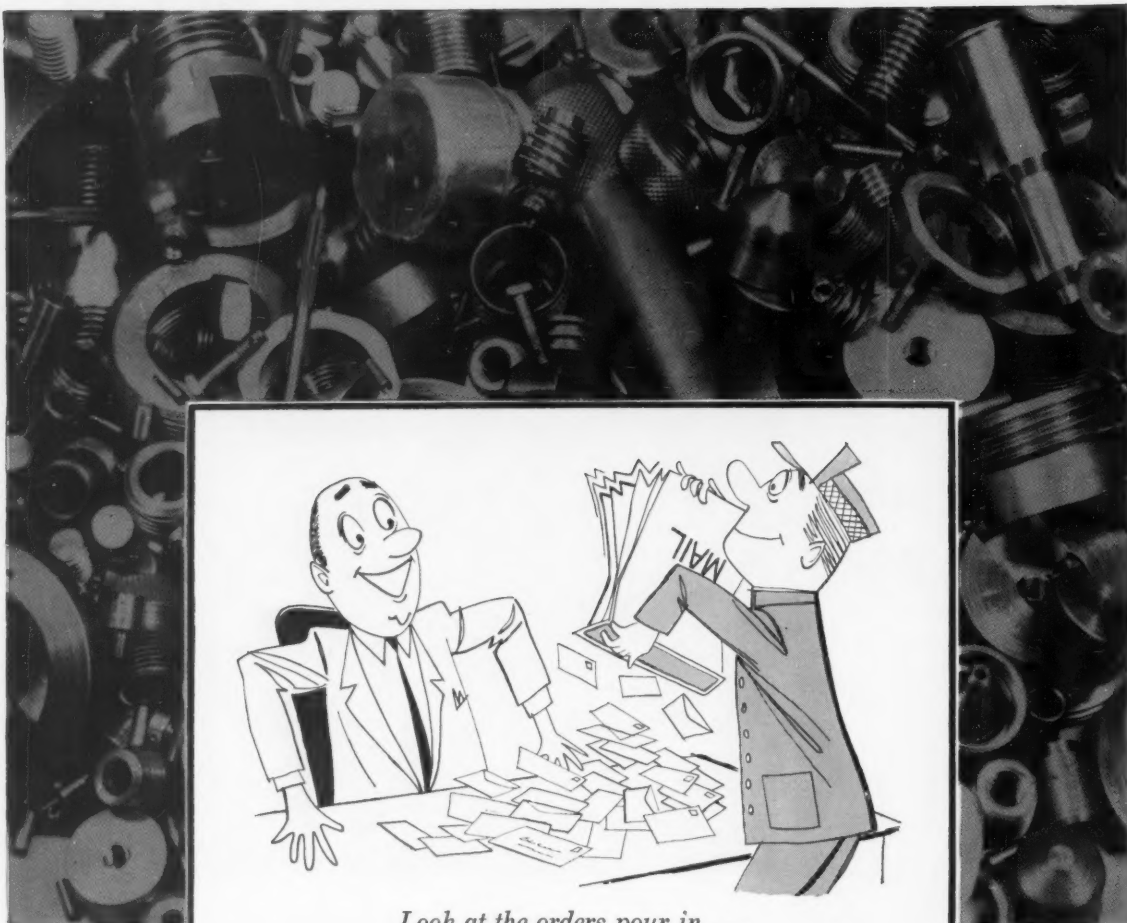
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS  
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



## SHELBY SEAMLESS MECHANICAL TUBING



UNITED STATES STEEL



*Look at the orders pour in . . .  
now that we've got our prices down by using MX*

You give yourself—and your customers—a break when you switch to USS Free-Machining MX Steel.

With this faster-cutting screw stock your production goes up and your costs come down. Your screw machine parts, no matter how intricate, can be turned out at higher speed. More accurately. With better finish. And with less tool wear.

Although it costs no more than ordinary screw stock, USS Free-Machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used for

the everyday jobs which are the backbone of the industry. What's more, MX works *with* your tools not against them . . . will prolong tool life up to 200%.

As a result, cost savings with USS MX have run as high as 42%—generally average between 10 and 15%.

Such savings have been so consistently recorded in every shop where MX has been given a thorough trial that we feel safe in saying that *MX will cut the cost of any part you now machine from ordinary screw stock. The more machine work required, the greater your savings.*

You can easily prove this for yourself by giving MX a production run in your own shop. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH  
AMERICAN STEEL & WIRE DIVISION, CLEVELAND  
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO  
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.  
UNITED STATES STEEL SUPPLY DIVISION  
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST  
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

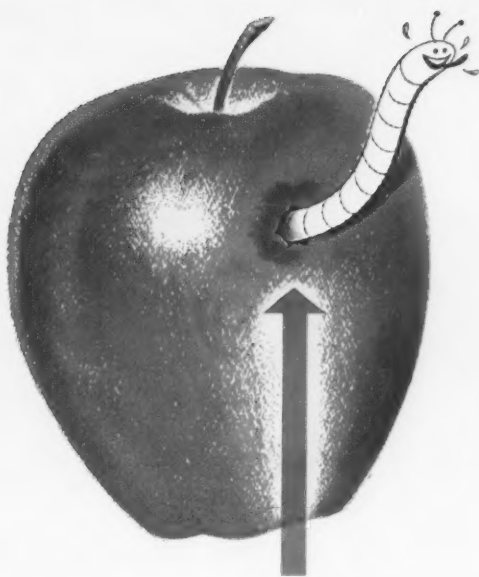
**Longer tool life . . . bigger output . . . lower costs**



**— when you do the job with free-machining**

**MX**

**UNITED STATES STEEL**



a hole here makes waste...



a hole here saves waste

**Crucible Hollow Tool Steels** save waste — time and money — whenever you need ring-shaped parts or tools with a center hole. For the hole is in the piece when you get it! You eliminate drilling, boring, rough-facing operations — save machine capacity for productive work.

And you can get Crucible Hollow Tool Steels in *any* of our famous tool steel grades . . . in bar lengths or saw cut to your individual requirements. They are made in practically any combination of O.D. and I.D. sizes. What's more, delivery is *immediate* with Crucible's popular KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot work tool steel grades from warehouse stocks.

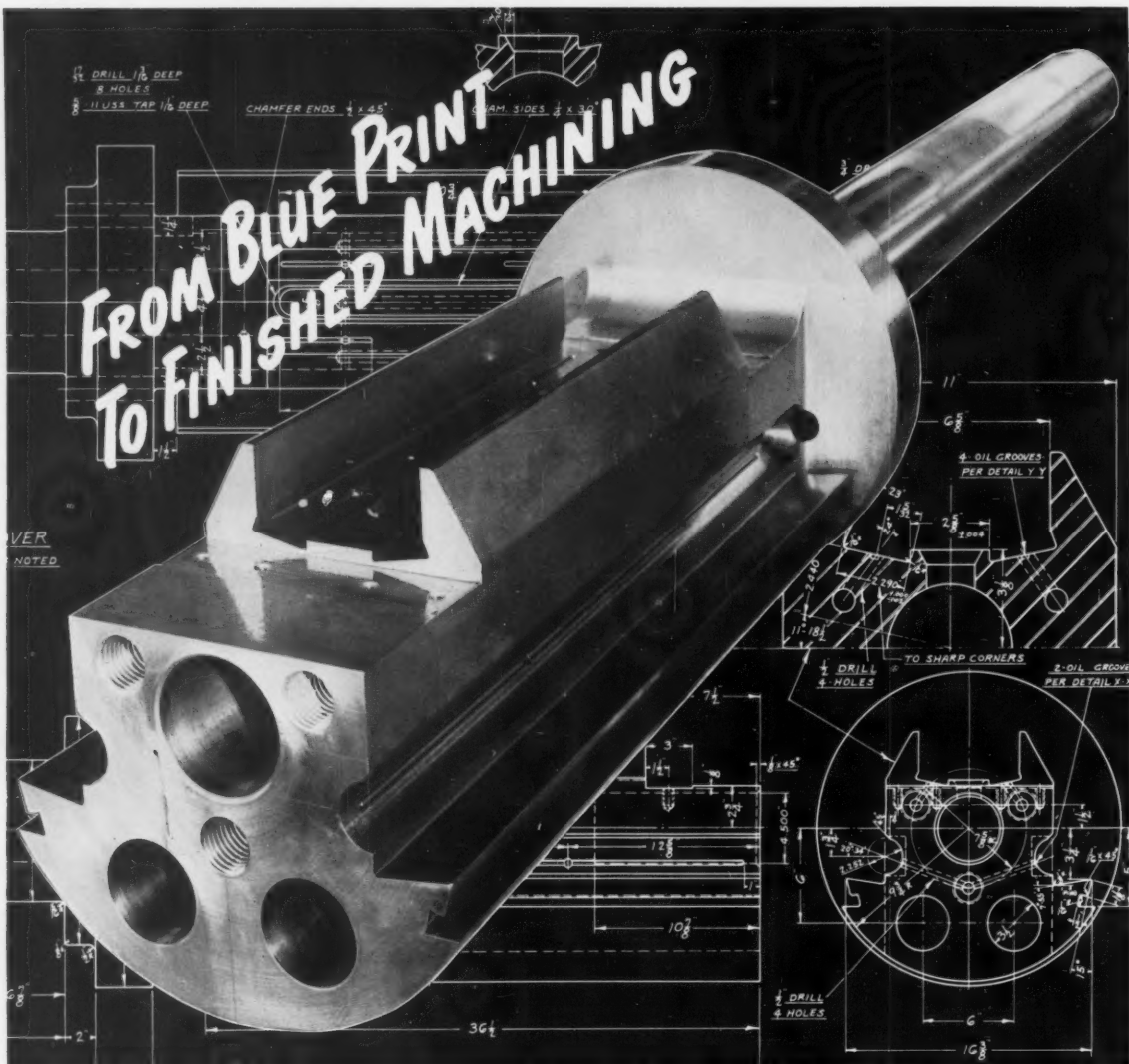
Next time you have an application with a center hole, let your Crucible representative show you how these hollow tool steel bars can save you money and time. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE**

first name in special purpose steels

**Crucible Steel Company of America**

Canadian Distributor — Railway & Power Engineering Corp., Ltd.



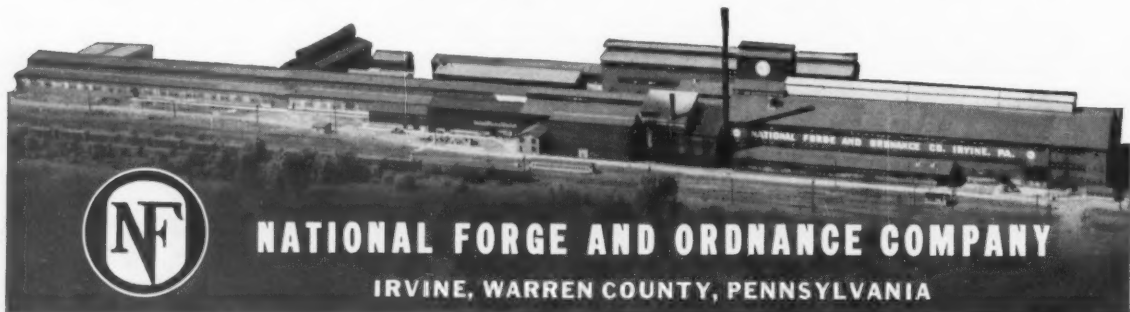
This block Body for a Tension Reel represents the coordinated effort of many National Forge skills in turning out the required electric alloy steel, the proper heat treating and the intricate machining to exacting tolerances.

National Forge offers you complete forging

service in one plant — under one responsibility.

Why not take advantage of this "all-in-one" service the next time you need forgings?

For full information, write **NATIONAL FORGE AND ORDNANCE COMPANY**, Irvine, Warren County, Pennsylvania.



**NATIONAL FORGE AND ORDNANCE COMPANY**  
IRVINE, WARREN COUNTY, PENNSYLVANIA



# Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corp., Export Distributors Bethlehem Steel Export Corp.



## Want Fast Tool Steel Service? SEE YOUR BETHLEHEM DISTRIBUTOR

Whether you want to order a quantity of tool steel, or merely a short bar, or just would like a bit of advice about the correct method of heat-treatment, you're sure to find your Bethlehem tool steel distributor anxious to be of service.

Prompt service is your distributor's middle name. He makes it a point to know your city like a book

—its background, its people, its industry. He knows what grades of steel you are most likely to need, and in what quantities. And so he keeps large stocks of Bethlehem tool steel on hand, in a virtually endless variety of types, all of them ready to go at a moment's notice.

If you would like bars cut to special length, or if there's a tricky

phase of metallurgy or some other tool-steel problem troubling you—again, your distributor is at your beck and call. He's a real friend. They don't come any better. It will pay you to get to know him.



**SOME OF THE GARLOCK 2,000**

**Want some answers  
TO AIRCRAFT SEALING PROBLEMS?**

It takes a lot of seals to answer *all* the sealing problems an aircraft engineer encounters. Each problem has its own peculiar service conditions. That's why we offer "the famous Garlock 2,000," two thousand different kinds of packings, gaskets, and seals for every conceivable need (The *only* complete line).

Knowing when and where to use each of "the Garlock 2,000," is the sole responsibility of Garlock's 125 engineer salesmen. Each has a vast wealth of experience in the use of *all* sealing materials.

That's why you save time by consulting your local Garlock man at the *start* of a project. Call him today or write for Catalogs.

	<p>Garlock Silicone Rubber Seals and Gaskets for ground airframe openings, or on hot jet engines, remain flexible at both high and low temperatures . . . resist aging, ozone, weathering. Write for Catalog AD-147.</p>		<p>Garlock Teflon* Products for maximum sealing efficiency against all aircraft fuels, acids, and alkali solutions . . . at temperatures from -110° to +500° F. Write for Catalog AD-155.</p>		<p>Garlock Klocure** Oil Seals protect all-important instrument, apparatus, and engine bearings, will do the job you specify with minimum power loss and heat generation. Write for Catalog 10.</p>
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\*DuPont Company Trade Mark

\*\*Registered Trade Mark

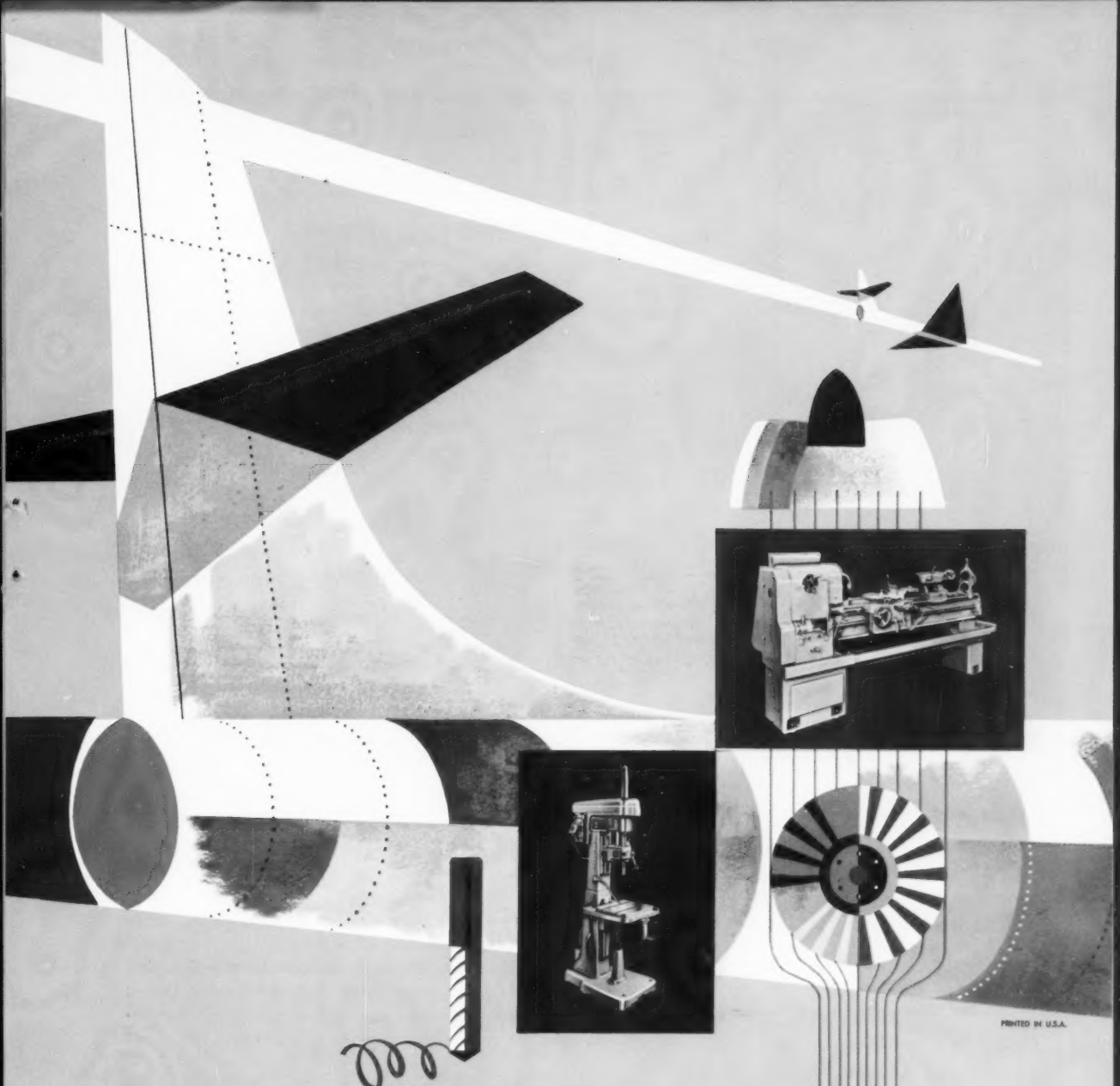
**THE GARLOCK PACKING COMPANY, Palmyra, New York**

For Prompt Service, contact one of our 30 Sales Offices and Warehouses throughout the United States and Canada.

**GARLOCK**



Packings, Gaskets, Oil Seals, Mechanical Seals,  
Rubber Expansion Joints



PRINTED IN U.S.A.

AIRCRAFT AND ACCESSORY BUILDERS are continually fighting obsolescence; continually replacing their 23,000 drilling machines and 16,000 lathes.\* They know that production economy suffers with half their machine tools built to World War II standards. Your wide-awake competition knows that 56% of this entire country's machine tools are 10 years old and older. So do aggressor nations.

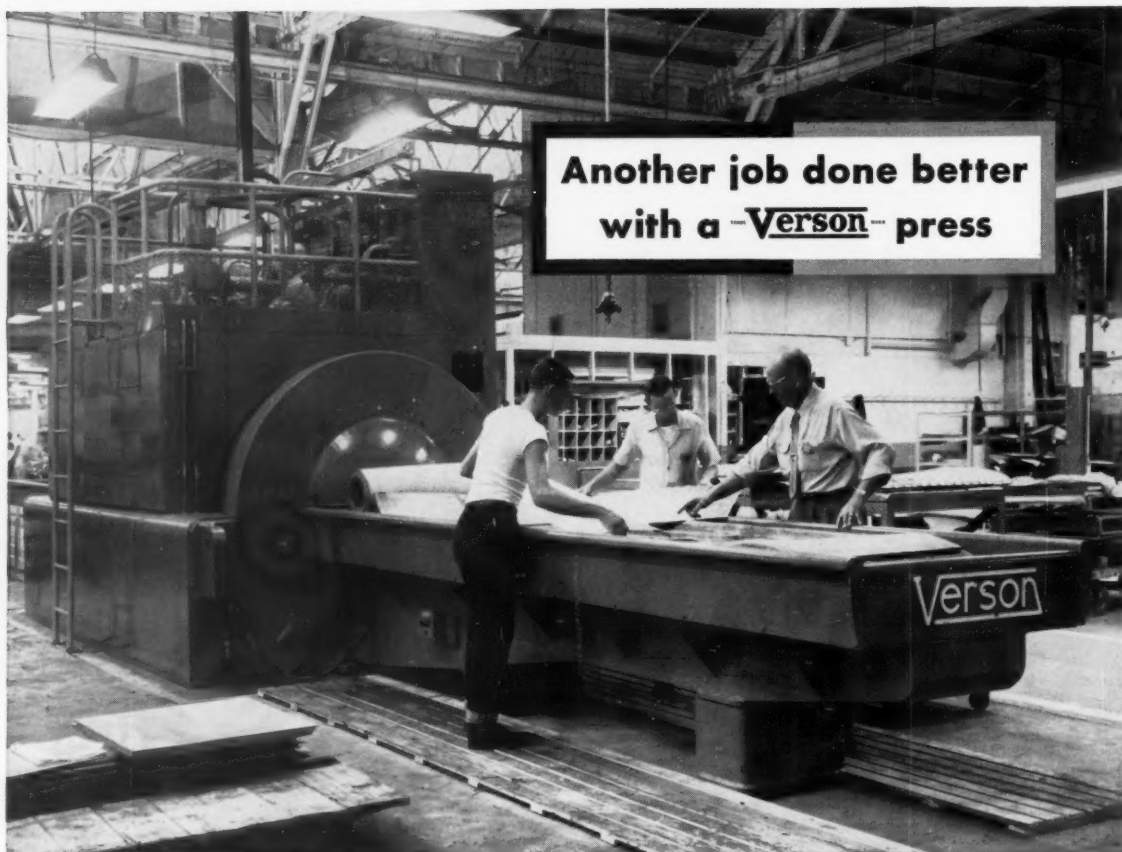
Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

\*Figures from American Machinist's Seventh Inventory.

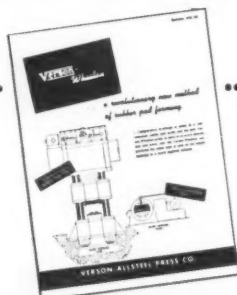
center on... **cincinnati lathes and drills**



Machines shown are Cincinnati's new 16" Sliding Head Drill and 15" Tray-Top Lathe.



## 19,440 Tons of Force Forms F-89D and B-62 Parts in this Verson-Wheelon Press at Northrop . . .



Specifications, operating data and illustrations of typical jobs are given in the Verson-Wheelon Bulletin. Write for your copy, today.

A key part of Northrop Aircraft's facilities for the Scorpion F-89D and Snark B-62 programs is this Verson-Wheelon Direct Acting Hydraulic Press. Rated at 19,440 tons capacity, this Verson-Wheelon is used for rubber pad forming of aluminum and steel parts.

The Verson-Wheelon Press offers many advantages over conventional rubber pad forming presses. It is lower in first cost and more efficient in operation. The use of twin loading tables makes it possible to load one table while the other is in the pressing chamber. Most parts are completely formed in the press without need for hand finishing.

If you do rubber pad forming or short run forming, investigate the Verson-Wheelon Press. A complete range of tonnages is available from 1200 to 42,000. For recommendations, send an outline of your requirements.

A Verson Press for every job from 60 tons up.



ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

**VERSON ALLSTEEL PRESS CO.**

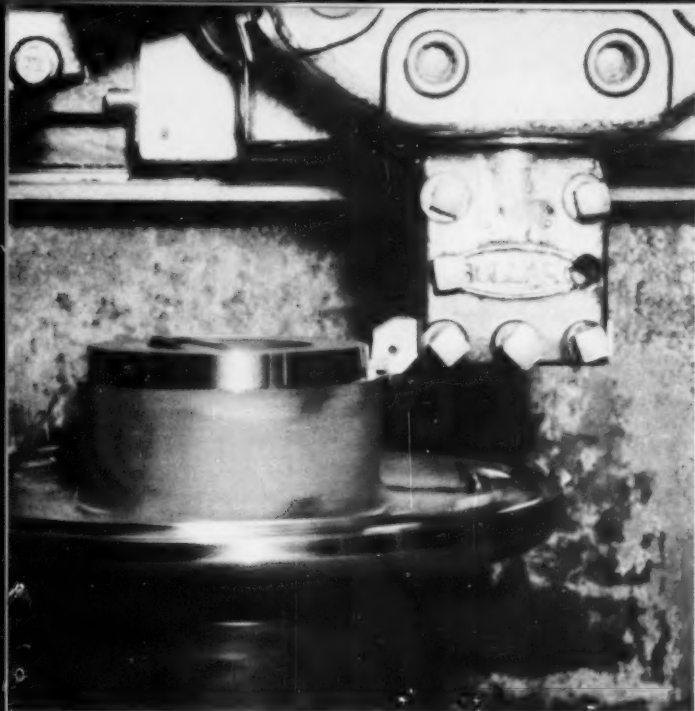
9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • Verson-WHEELON HYDRAULIC PRESSES

106A—MACHINERY, July, 1956

For more information fill in page number on Inquiry Card, on page 261





## carbide NEWS

**WESSON Multicuts send tool costs tumbling from 42 cents to 1 cent per piece**

# Tools Developed for High Output Pay Off on Low Volume Jobs

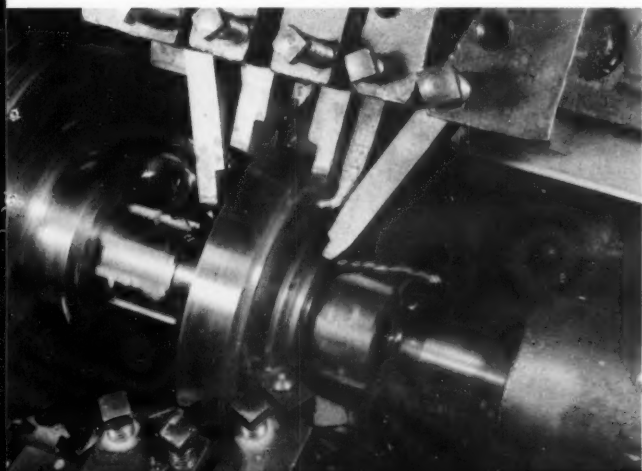
Sharply reduced tool costs and a 30 percent increase in production were the direct results of changing from conventional tooling to indexable insert carbide tooling at the plant of a mobile materials handling equipment builder. Thus the application of tools developed originally for volume production also paid off in producing parts at a relatively low output rate.

The job consisted of machining a cast steel hoist drum on a Bullard at a rate of 1.27 pieces per hour. The former tool cost of 47 cents per piece for facing and turning the flange, rough facing and turning the drum hub and finish facing and turning the hub was slashed to 1 cent as the result of a change to Wesson Multicut holders and Wessonmetal indexable carbide inserts.

Most of the former high tool cost was due to the fact that only 4 pieces per grind were obtained in machining the flange and roughing the hub. Currently the Wessonmetal WM inserts turn out 80 pieces per grind. Similarly the number of pieces in finishing the drum hub has gone up from 10 pieces per grind with the brazed tool formerly used to 120 pieces per grind with Wessonmetal WH.

Additional savings result from an 85 per cent reduction in down time for each tool change with the end result being a 30 per cent improvement in output.

Special note should be taken of the fact that these savings were achieved without resorting to special carbide grades. Both Wessonmetal WM and WH are strictly standard.



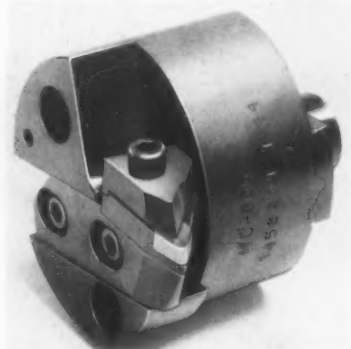
Here's a case where "equivalent" carbides, at least in the "Classification Code", gave considerably different performances. The job is rough and finish turning multiple diameters of 4021 steel forgings in an eastern gear plant. Tool life jumped from 180 to 750 pieces per grind when Wessonmetal WH (a C-7 grade) replaced the C-7 grade previously used. Tool costs dropped from 2 cents per piece to half a mill and production increased because of lower down time. The reason? Grade WH effectively resisted cratering where the other hadn't.



## Boring Tool Features Throw-Away Insert

Among the increasing number of boring cutters developed by Wesson to take advantage of the throw-away insert concept is a special cutter now being used to form an internal spherical radius on an automotive differential case to close tolerances.

As in most throw-away insert boring tool designs pioneered by Wesson, a number of exacting requirements had to be met before the design was accepted and the tool placed in service. Aside from the savings in setup time and the elimination of carbide grinding, the throw-away boring tool is holding extremely close limits on the radius to within plus .001-inch. Even closer tolerances are necessarily held on the insert and holder itself.



*Special boring cutter developed by Wesson forms internal spherical radius on automotive differential case.*

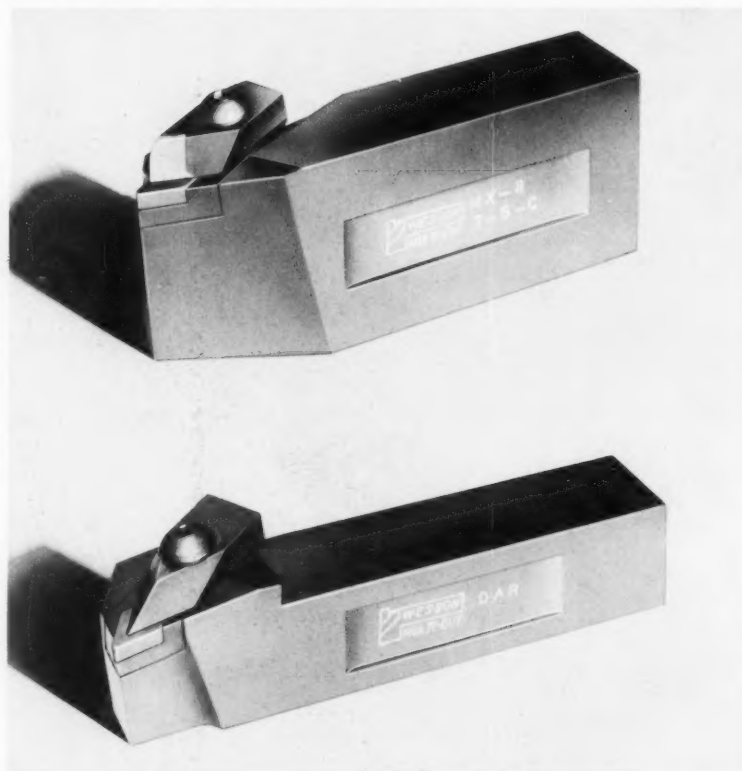
## Oscillating Tool Grinder Described in Bulletin

New "Poweramic" oscillating tool grinder is described in a 6-page, 3-color bulletin just released by Wesson. Designed for offhand grinding of standard and special single point carbide tools, the grinder takes the skill and effort out of grinding carbides, boosts output and gives finer finishes.

The oscillating wheel moves through a true arc at 150 strokes per minute, tool being held in a fixed position. Faster metal removal, hone-like (double cross-hatch) finishes and elimination of manual lateral tool movement are among features illustrated and described.

For full details on the Poweramic grinder write Wesson for Bulletin 56-A.

## New Holders Use Diamond Shaped Throw-Away Inserts



*Above is the MX-8-T5C holder specially designed for production copy turning lathes. Below is the right hand (DAR) model for plunge turning and facing.*

Three new holders for throw-away inserts have been added to the Wesson Multicut line. All three tools use Wesson standard diamond shaped D-55 throw-away inserts. The holders, designated as semi-standard, mount the insert right hand (DAR), left hand (DAL) and centrally (MX-8-T5C).

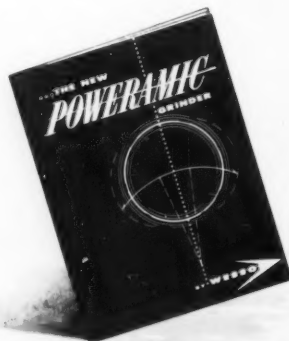
All features, including method of locking and clamping, use of adjustable chip breaker clamp, anvil relieved for

built-up edge, etc. are similar to those in the standard line of Multicut holders.

DAR and DAL holders are particularly suitable for plunge turning and facing operations. The MX-8 type is designed for use on various production copy lathes and, on machines of this type, frequently eliminates subsequent finish turning or grinding operations.

Each insert used in any of the three holders in this series has four cutting edges. It is indexed progressively and discarded after all edges are used up.

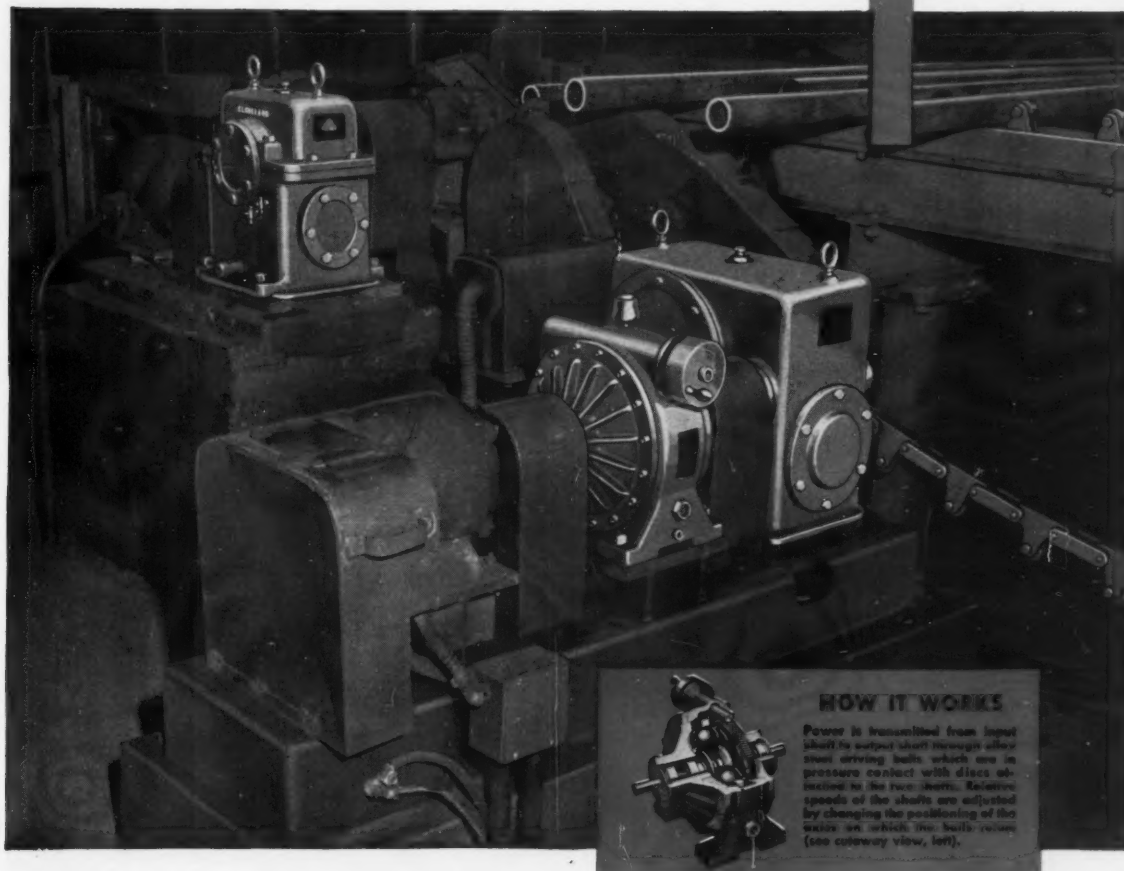
For additional details on these holders ask for Bulletins DAR-DAL and MX-8.



**Wesson**  
carbide  
**Wessonmetal**  
**WESSON COMPANY DEPT. AD**  
1220 Woodward Heights Blvd., Detroit 20, Mich.  
IN CANADA:  
**WESSON CUTTING TOOLS, LTD.**  
93 LEICESTER AVE., TORONTO 18, ONTARIO

## Hot pipe conveyor travels at precision pace set by CLEVELAND Speed Variator

Drag-type conveyors  
utilizing Cleveland  
Speed Variator Size  
6K4 Series 1. Driving  
Cleveland Double  
Reduction Worm Gear  
Size 051D Series F,  
ratio 900:1.



### HOW IT WORKS

Power is transmitted from input shaft to output shaft through alloy steel driving belts which are in pressure contact with discs attached to the two shafts. Relative speeds of the shafts are adjusted by changing the positioning of the discs on which the belts ride (see cutaway view, left).

**T**HIS hot pipe conveyor produced by York-Gillespie Mfg. Co. is a good example of the precision engineering applied in steel mill operation today. Conveyor speed has to coincide exactly with the speed of other operations on the line—has to adjust to the pace of production anywhere in the line. That's why a Cleveland Speed Variator is on the job! Being infinitely variable, the Speed Variator gives stepless speeds over its full 9:1 range—from  $\frac{1}{4}$  to 3 times input speed. Output speed is adjusted manually by a hand wheel mounted on the Variator—but could be regulated automatically by remote controls of various types.

The Cleveland Speed Variator provides these major advantages: 1. An extremely compact unit with input and output shafts in line and rotating in the same

direction; 2. Almost any input speed up to 1800 rpm can be used—either clockwise or counterclockwise rotation; 3. Rated for constant horsepower output over a 9:1 range, or for constant output torque with a 6:1 range; 4. Infinitely variable over the entire speed range; 5. Rapid response to speed change, precise adjustment, and accurate maintenance of speed settings; 6. Long life and minimum maintenance due to absence of belts or complicated linkages; 7. Ample bearing support for overhung pulleys on either input or output shafts.

This revolutionary variable speed drive is available in eighteen standard types and sizes. For detailed description of the Cleveland Speed Variator with photographs, sectional drawings, rating tables and specifications, write for Bulletin K-200.

## THE CLEVELAND WORM AND GEAR COMPANY

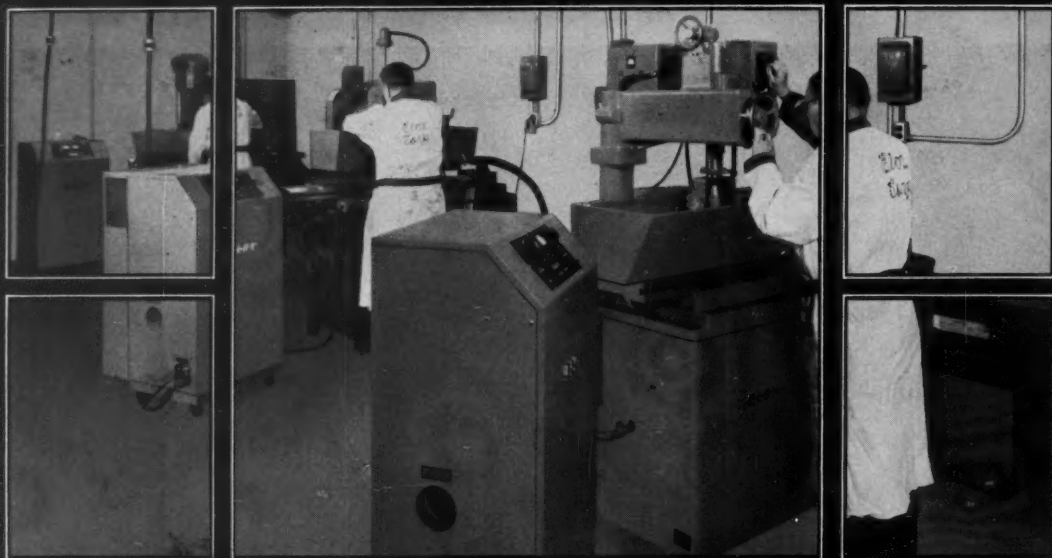
Speed Variator Division, 3276 East 80th St., Cleveland 4, Ohio

*Sales representatives in all major industrial markets. In Canada—Peacock Brothers Limited.*

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—107

a room with a view  
**TO THE FUTURE**

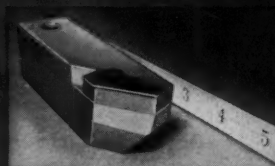


This is the Elox "Demo Room". The demonstration center where we prove that the machining of jobs formerly difficult or impossible can be done with ease and economy by Electrical Discharge Machining.

This "proof division" at Elox will run not just a few samples for you but enough quantity production to provide a real evaluation of how Elox E.D.M. can save time and money in your plant. Tungsten carbide tipped single point tools, forging dies, die casting dies and tungsten carbide form tools will be machined at a cost we guarantee cannot be duplicated by any other method. Make use of our Elox "Demo Room". It has proven to hundreds of alert firms that these jobs can be done better, faster, less expensively.

**WHATEVER YOUR COSTS ARE  
NOW...CONTACT ELOX**

**elox** *corporation of michigan*



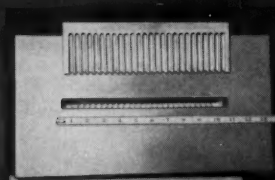
**WE SAVED  
19 MINUTES**

grinding this single  
point tungsten car-  
bide tip boring tool.



**WE SAVED  
16 HOURS**

plus 7 different  
operations on this  
form grinding of a  
carbide broach.



**WE SAVED  
379 HOURS**

on the machining of  
this die casting die.

123 Stevenson Hwy.  
Royal Oak 3, Michigan



# CUSHMAN chucks

## give *Chuck-ability*

**CHUCK-ABILITY** — The ability to **SPEED** your work . . . **ELIMINATE** fatigue . . . **IMPROVE** your products . . . and **REDUCE** your costs . . . through design and selection of the right work-holding devices.

**the key to machining efficiency**



Efficient machining of jet engine parts of large diameter and small cross-section to extremely close tolerances without strain or distortion was materially improved by the Cushman series of special chucks designed and built for this purpose.

These chucks completely overcome the inherent difficulties of the operations and permit mass production of these vital component parts. The success of these new chucks is one more proof that Cushman gives **Chuck-ability** as an essential to efficient production.

Manufacturers throughout the country have long recognized and used the Cushman Engineering Department for solutions to chucking problems. We invite you to use this experienced service.

### THE CUSHMAN CHUCK COMPANY

Hartford 2, Connecticut

a world standard for precision

**CUSHMAN  
CHUCKMAN**

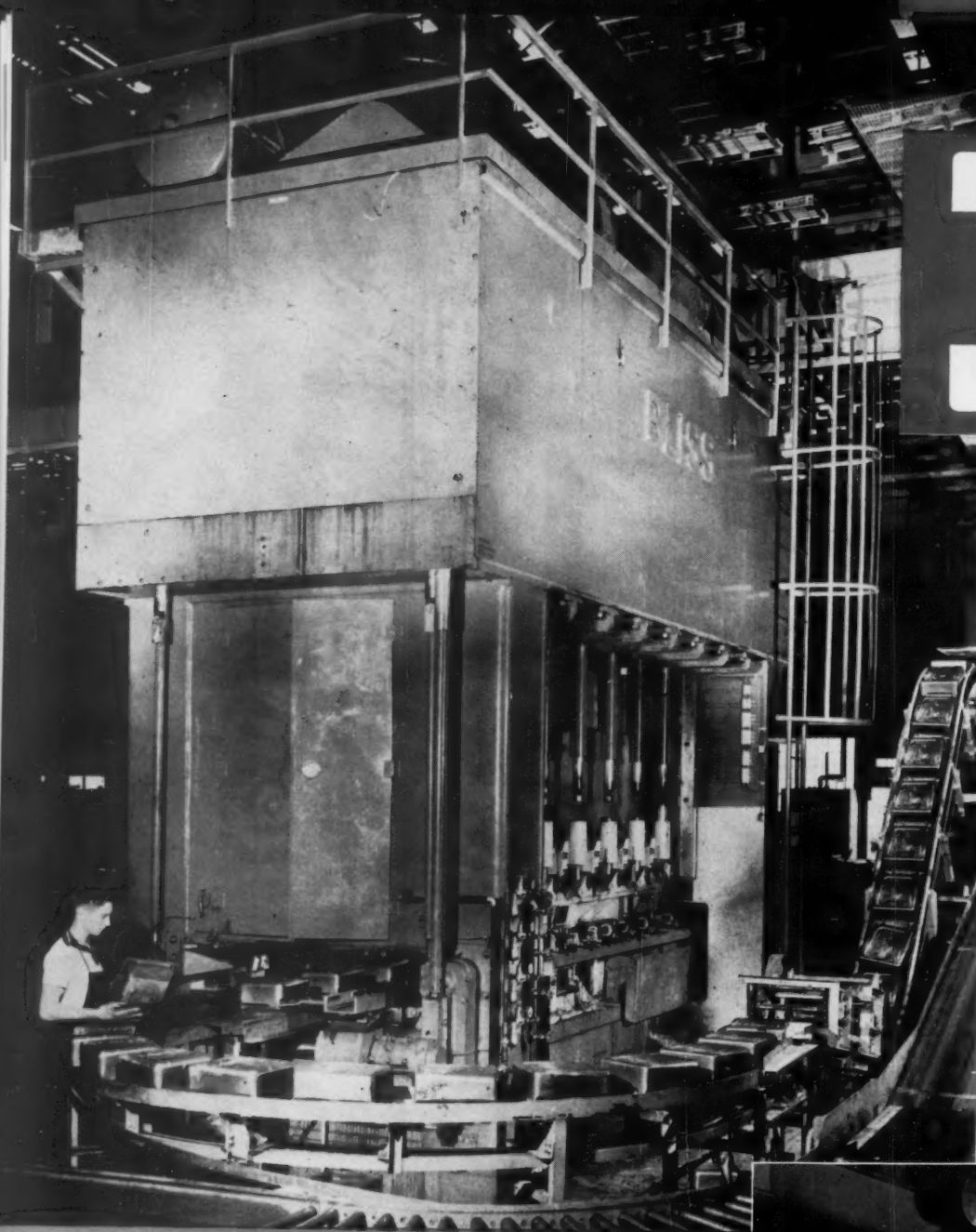
CHUCKS AND ACCESSORIES  
Established  
1867

**SEE YOUR INDUSTRIAL DISTRIBUTOR**

manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

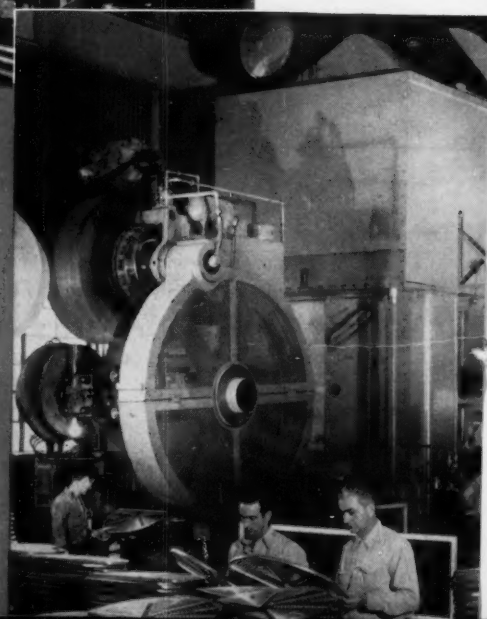
# 3



**THIS ONE MAKES PANS . . .** Pans are produced at the rate of ten a minute in this 700-ton seven-station Bliss transfer feed press. A 22" x 24" blank is drawn 5 1/2" deep in the first station; trimming, piercing and restriking operations follow. Pans leave the press completely finished — ready for pickling and enameling.



**THESE TWO MAKE SHELVES . . .** "Lazy Susan" shelves by the millions are the product of these two 800-ton Bliss transfer feed presses and the two Bliss embossing presses stationed at their output ends. Coil stock is blanked in the first stations of the presses and work pieces carry through the remaining five stations and into the embossing press automatically. Each press produces 15 shelves per minute through two shifts.



# BLISS TRANSFER FEED PRESSES STEP UP GE REFRIGERATOR PRODUCTION

***Between them, they make all the pans and all the shelves GE needs for its annual output of more than half a million refrigerators!***

Here's what's happening at Appliance Park: 6000-pound coils of steel feed into one end of these Bliss transfer feed presses, lines of shelves and pans march out the other ends, and only a few attendants stand by in between.

Three separate press lines are involved. One is a 700-ton, seven-station press (with coil cradle, straightener and roll feed) that produces ten deep-drawn pans a minute.

The other two — identical set-ups — are 800-ton, six-station presses, also with cradle, straightener and feed, which feed into 800-ton embossing presses (see photo). Each produces shelves at the rate of 15 per minute.

The method of operation is the same for all. Mill coils are loaded on the cradle. From there, strip feeds through the straightener and into the roll feed.

At the first die station in the press a blank is cut off. The transfer feed fingers move in on the work piece and carry it to the next station. As the slide comes down, the fingers move out; as it rises, they move in and repeat the cycle. New strip is brought to the first station and a completed part delivered with every stroke of the press.

This set-up has solved a number of knotty problems for General Electric. Previously production required the services of two or three vendors, doubling and tripling the cost of dies and labor. Still further savings have come from the use of standard mill coils instead of blanks. In fact, the savings are expected to bring about an early amortization of the entire installation.

Bliss has been building transfer feed presses and systems like this since

Spanish-American War days; today, over a thousand are in use. If you're faced with long-run production problems, let a Bliss engineer show you some typical uses of the transfer feed principle. Perhaps it can pull your production costs into line — as it has for so many others.

**SEE IT IN ACTION . . .** A new color-and-sound movie takes viewers to the plant, shows the press in action. See close-ups of tooling, of transfer fingers, of coil feed techniques. To arrange a showing at your plant, write to E. W. Bliss Company, Canton, Ohio, or see your local Bliss representative.

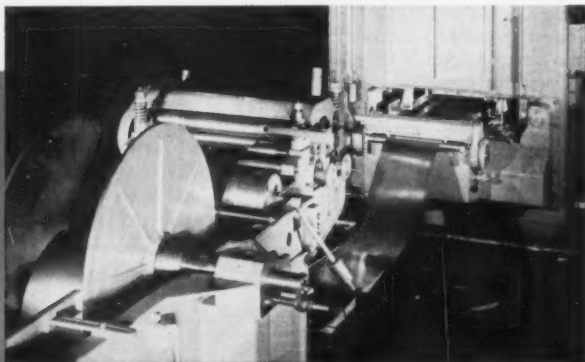
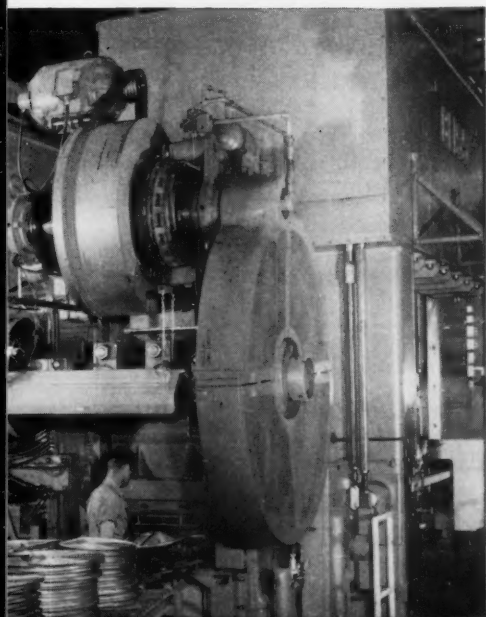
**BLISS**  
SINCE 1857

**E. W. BLISS Company, Canton, Ohio**

**PRESSES, ROLLING MILLS, SPECIAL MACHINERY**

*is more than a name... it's a guarantee*

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Calif. Branch Offices in Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. Other representatives throughout the world.



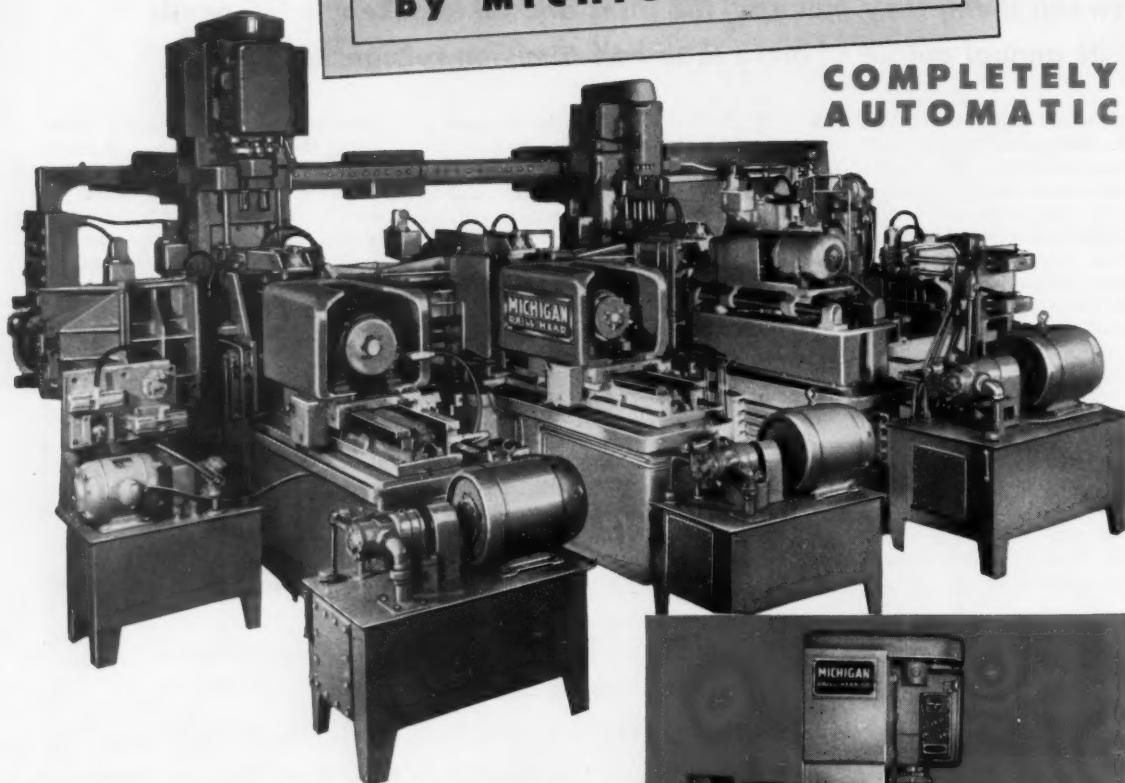
**ALL THREE LINES WORK FROM COIL STOCK . . .** A number of handling operations are eliminated because, on each of the three presses, strip from standard-sized mill coils are fed from this power coil cradle through a five-roll straightener and into the roll feed on the press. Blank is cut off in the first die station of the press. Though not shown here, a second coil is ordinarily held ready at the rear of the cradle to speed handling. Bliss engineers designed all the coil handling equipment and all of the tooling for each of the presses.



# TRANSFER MACHINE

by MICHIGAN DRILL

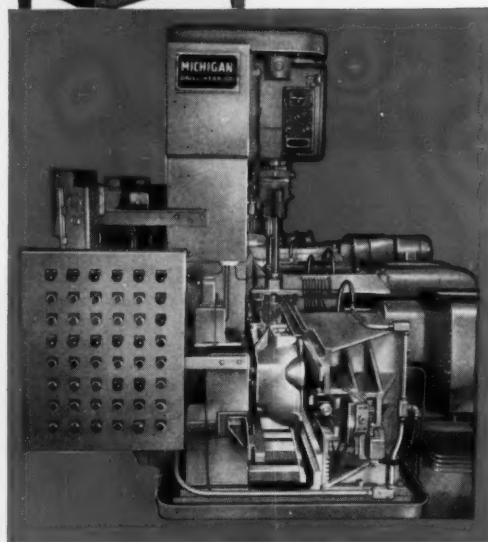
**COMPLETELY  
AUTOMATIC**



## **FOR DRILLING, CHAMFERING, TAPPING, ROUGH BORING—FINISH BORING**

Shown is Four Double End Machine with a transfer System moving Torque Converter Housing automatically through the machine. In addition the part is laid on a roller conveyor after all the machining operations are completed. Machine is designed in such a manner that additional stations can be added at any time. The part, when placed in the transfer track, makes a limit switch and the cycle is automatic.

**for faster, More Economical Production**



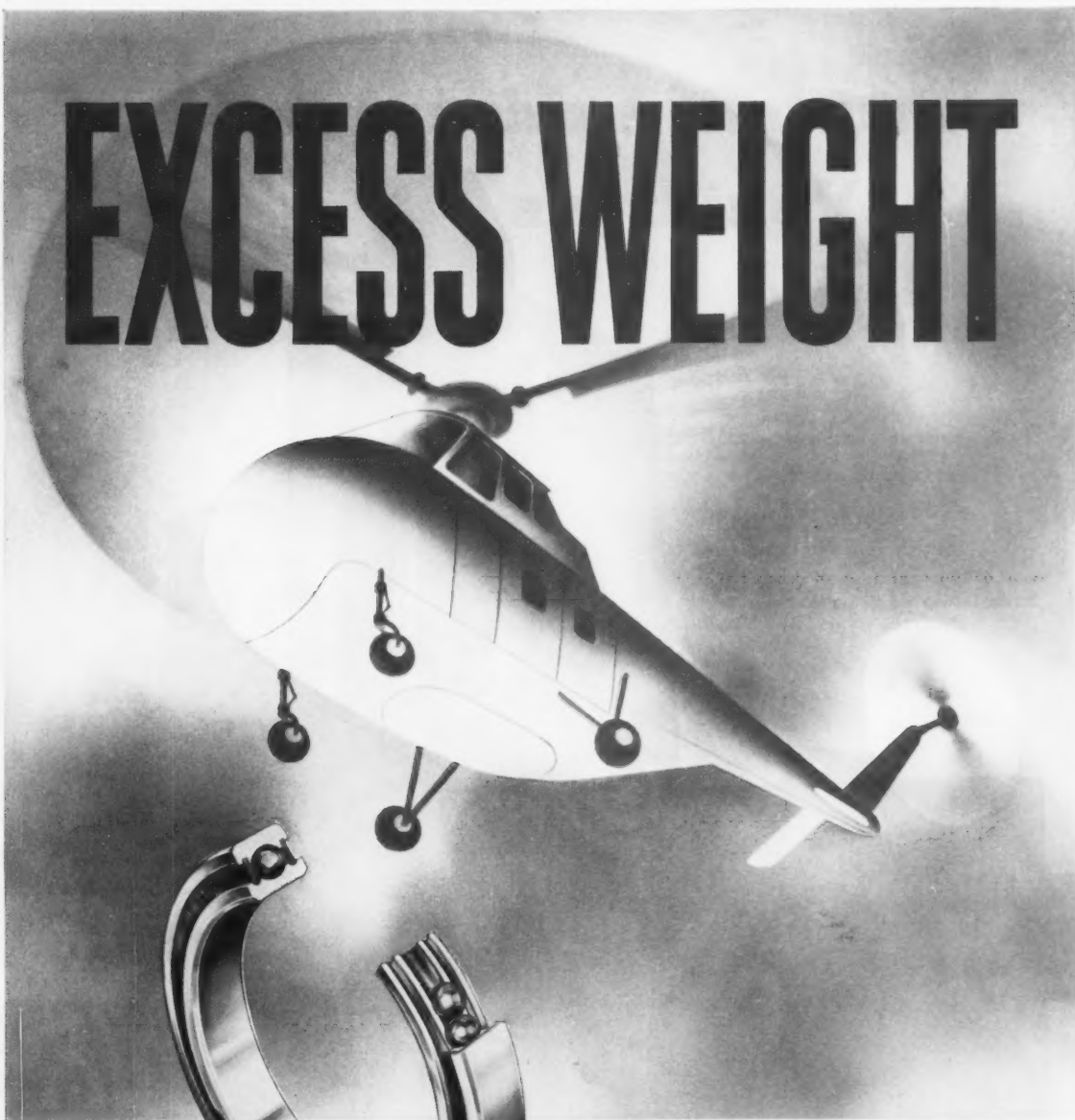
**DRILL HEAD CO.** Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment



An attitude and an aptitude for solving bearing problems...

# EXCESS WEIGHT



Fafnir B500DD Series  
extra-thin section,  
torque tube type ball bearing  
with close-clearance,  
non-metallic shields

# FAFNIR

**Rising to the challenge** of the aircraft industry—to reduce weight to a minimum and conserve space needed for pay loads, Fafnir developed the thinnest of all ball bearings equipped with shields.

The B500DD Series is designed to provide protection from dirt, retention of the precise amount of lubricant, and resistance to corrosion of exposed surfaces. Since only the simplest type of housing is required, this extra-thin section bearing saves both space *and* weight.

Perhaps this newest Fafnir Bearing development, or the ingenuity that produced it, can help you solve a weight problem. The Fafnir Bearing Company, New Britain, Conn.

MOST COMPLETE LINE IN AMERICA



For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—113

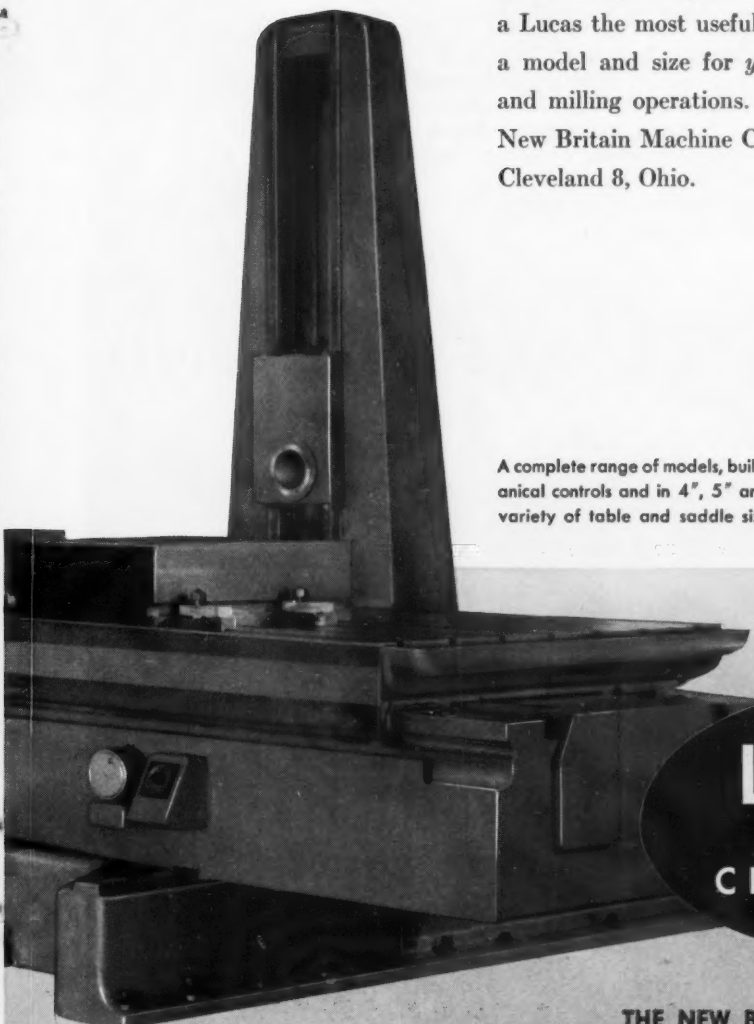
Model 6120 Lucas Precision Horizontal  
Boring, Drilling and Milling Machine.



# **"the machine that can do anything"**


Extreme accuracy, feather-touch pendant control, automatic power positioning for repetitive work make a Lucas the most useful machine in any shop. There's a model and size for *your* horizontal boring, drilling and milling operations. Lucas Machine Division. The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

A complete range of models, built in 3", 4" and 5" spindle sizes with mechanical controls and in 4", 5" and 6" sizes with electrical controls. Wide variety of table and saddle sizes with two or four-way beds optional.



**LUCAS**  
OF  
**CLEVELAND**

A DIVISION OF  
THE NEW BRITAIN MACHINE COMPANY



## What's Your Bearing?

Performance limits for jet aircraft engine components are headed in just one direction today—*straight up!*

Higher speeds, higher temperatures call for higher precision, higher dimensional stability.

Developmental work at Rollway is aimed at achieving more usable horsepower through the greater efficiencies realized at higher operating temperatures. New, high temperature steels are being examined for penetration into speed and temperature zones never before attempted.

To help you get your bearings in a hurry, call on Rollway for:

- 1 First-line engineers who have experience with high-temperature steels.
- 2 Flexibility of service from laboratory to delivery schedule.
- 3 Down-to-earth cooperation by engineering, design, and quality control people . . . every step of the way.
- 4 Thorough performance charting, up to and including pre-installation testing.

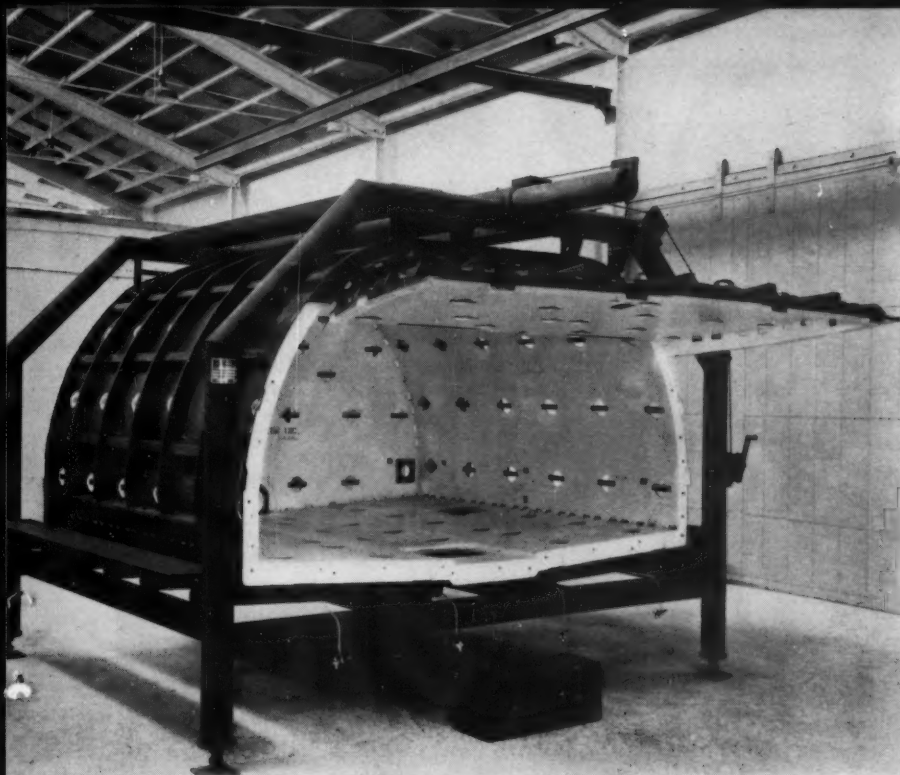
Wire, call or write ROLLWAY BEARING COMPANY, INC.  
582 Seymour Street, Syracuse 4, N. Y.

# ROLLWAY BEARINGS

Complete line of Radial and Thrust Cylindrical Roller Bearings

ENGINEERING OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto • Pittsburgh • Cleveland • Milwaukee • Seattle • Houston • Philadelphia • Los Angeles • San Francisco





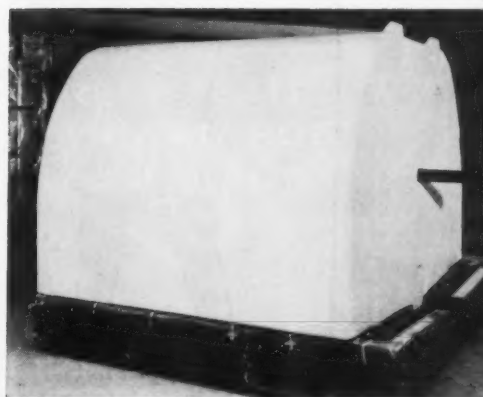
Plastic checking fixture is a lamination of glass cloth layers with compounds based on BAKELITE Epoxy Resins. It was built by W. B. Whittington Co., Los Angeles, Calif., using "Epocast" compounds formulated by **Furane Plastics, Inc.**, Los Angeles 39, Calif.

*Huge epoxy-built checking fixture*

# Holds tolerances to $\pm .004$ in.!

Fitting a fuel cell in the B-52A is a tight squeeze. They're checked for size in this big—and highly accurate—plastic checking fixture. Its 249 check points match those on the plane with tolerance of  $\pm .004$  in.!

Such precision in a fixture so large reflects the dimensional stability in plastic tools made with glass cloth and compounds based on BAKELITE Brand Epoxy Resins. These compounds are handled as liquids, are readily formed and cure at room temperature, to an extreme hardness that permits precision machining. Finished tools are tough, lighter-in-weight, durable. As a result, manufacturers faced with fast model changes use these plastic materials to speed both tooling and production.



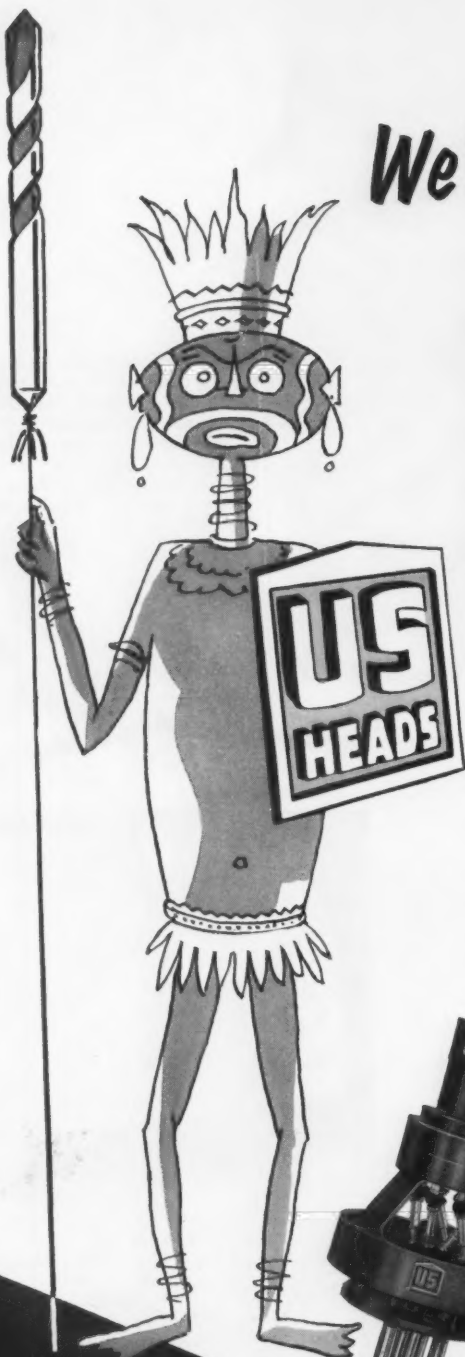
Mold around which fuel cell is formed gives indication of tank's size. Checking fixture is even larger, since it measures outside dimensions.

*For  
metalworking...*



**BAKELITE COMPANY**, A Division of Union Carbide and Carbon Corporation **UCC** 30 East 42nd Street, New York 17, N. Y.  
The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

# We're Looking for Head Hunters!....

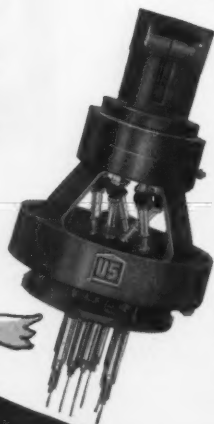


Most machine tool men have long relied upon the "US" Adjustable Multiple Spindle Drill Heads. But we are looking for those who still haven't tried them . . . and who are looking for the best.

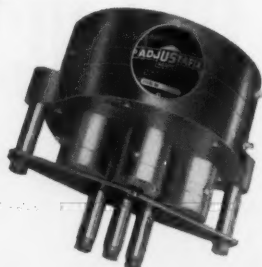
With their quick-change universal joint assemblies, they are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating. All gears are hardened and shaved with spindles superfinished.

The single eccentric type is used for equally spaced holes on bolt circles.

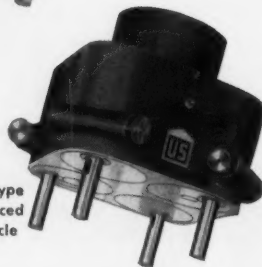
The new double eccentric AdjUstafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.



Universal joint with  
slip spindle fixed lo-  
cating plate



Double eccentric type  
for irregular spacing



Single eccentric type  
for equally spaced  
holes on bolt circle

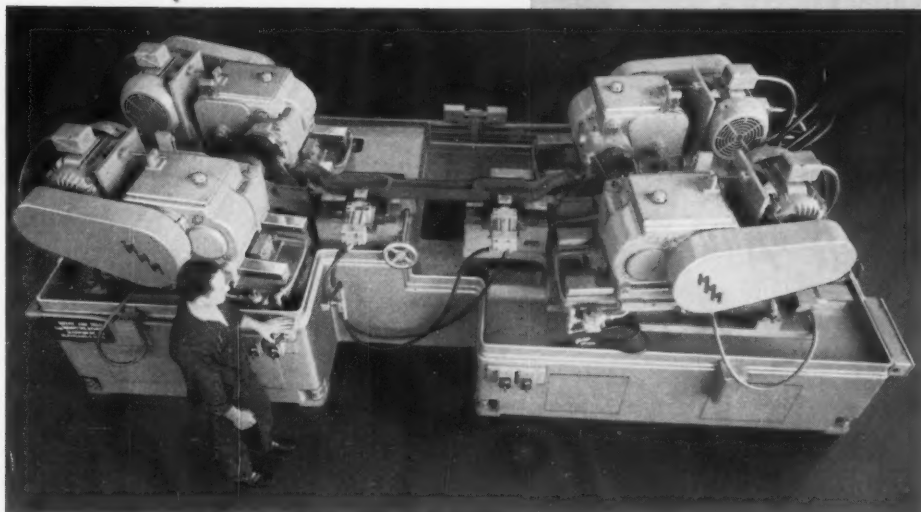
**Write** for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

**UNITED STATES DRILL HEAD COMPANY**  
BURNS STREET • CINCINNATI 4, OHIO

# MIGHTY BIG JOB

## MINIMIZED by another

### MOTCH & MERRYWEATHER *Production Solution*

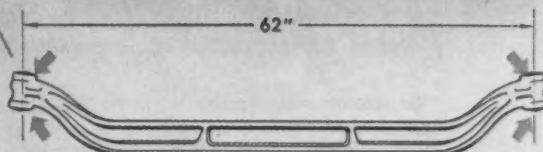


*Traveling head universal double duplex milling machine.*

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universality into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

*Write for Bulletin S-56 describing  
M. & M. Duplex Milling Machinery.*

**YOU'RE AHEAD  
WITH A HEAD FOR  
EACH SURFACE**



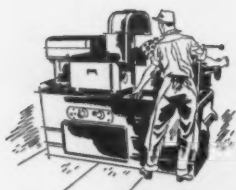
Operation: Milling kingpin bosses of truck axle.  
Material: . . . . . Forged steel.  
Brinell Hardness: . . . . . 217-255.  
Machine cycle time: . . . . . 30 seconds

## THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

*Builders of Automatic Precision Cut-off, Milling and Special Machinery*



*Plant tests prove  
Sinclair Wilkut "A"  
increases tool life up to  
150% on Beryllium Copper!*

One of the foremost manufacturers of industrial controls recently had an expensive problem with excessive drill wear on their automatic screw machines. Moreover, tool changes in mid-shift resulted in a substantial reduction of finished parts per 8-hour shift!

J. H. Thurow, Sinclair Industrial Representative reports: "They wanted to lengthen tool life to use not more than one drill per shift. But this was difficult as the beryllium copper being drilled had a Rockwell hardness of  $R_b$  88-92, with a machinability rating of 60."

*Finished parts production increased as much as 3.8 thousand per drill!*

"We recommended Sinclair WILKUT® 'A' as ideally suited for this job," continues Mr. Thurow. "Four competing oils were tested in a way that duplicated actual production conditions on their machines — 5000 RPM and 100 surface feet per minute. Results of drill life tests were quite impressive . . . the following shows the number of drills used per 8-hour shift:

Competitive Oil A — 1.60  
Competitive Oil B — 1.40

Competitive Oil C — 1.07  
**Sinclair WILKUT 'A' — 0.64**

"In terms of actual finished parts per drill, the tests showed:

Competitive Oil A — 2.40 thousand  
Competitive Oil B — 2.70 thousand

Competitive Oil C — 3.60 thousand  
**Sinclair WILKUT 'A' — 6.20 thousand**

It will pay you to get the facts on the performance benefits of non-staining type, sulfurized WILKUT Cutting Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y.

**SINCLAIR**

**CUTTING OILS and COOLANTS**



# 118 feet of automation—

performs machine operations on bank surfaces, valve lifter holes and distributor hole of V-8 engine block.

Outstanding features in this long transfer make it extremely practical, efficient and trouble-free.

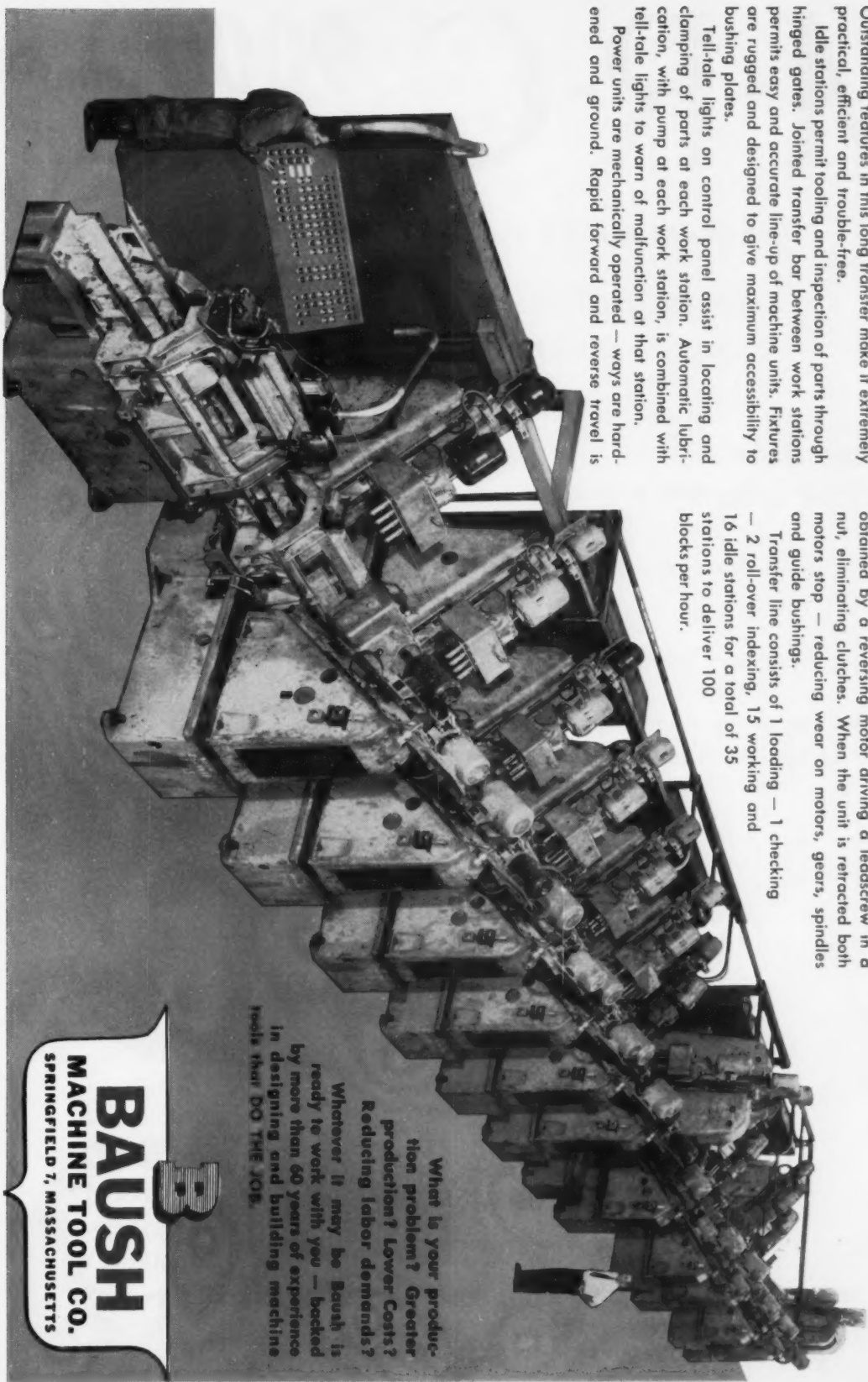
Idle stations permit tooling and inspection of parts through hinged gates. Jointed transfer bar between work stations permits easy and accurate line-up of machine units. Fixtures are rugged and designed to give maximum accessibility to bushing plates.

Tell-tale lights on control panel assist in locating and clamping of parts at each work station. Automatic lubrication, with pump at each work station, is combined with tell-tale lights to warn of malfunction at that station.

Power units are mechanically operated — ways are hardened and ground. Rapid forward and reverse travel is

obtained by a reversing motor driving a leadscrew in a nut, eliminating clutches. When the unit is retracted both motors stop — reducing wear on motors, gears, spindles and guide bushings.

Transfer line consists of 1 loading — 1 checking — 2 roll-over indexing, 15 working and 16 idle stations for a total of 35 stations to deliver 100 blocks per hour.



What is your production problem? Greater production? Lower Costs? Reducing labor demands?

Whatever it may be Baush is ready to work with you — backed by more than 60 years of experience in designing and building machine tools that DO THE JOB.

**BAUSH**  
MACHINE TOOL CO.  
SPRINGFIELD 7, MASSACHUSETTS

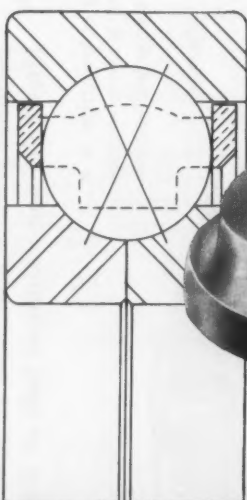
# M-R-C 9000 series BALL BEARINGS

originated by M-R-C and manufactured for 38 years—

*ideal for applications requiring maximum thrust capacity in both directions, in single-row bearing space.*

## Advantages of the M-R-C 9000 Series Ball Bearings:

- Equal thrust capacity in both directions.
- Provide maximum load carrying through optimum ball complement.
- Often permit replacement of duplex pair of bearings with single bearing.



M-R-C Engineers are available for  
consultation on your bearing problems.



**MARLIN ROCKWELL CORPORATION**

Executive Offices: JAMESTOWN, NEW YORK



### *Guaranteed Accuracy*

More and more manufacturers apply SIP *Guaranteed Accuracy* to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.



NORTHERN ORDNANCE INCORPORATED

American Optical



BARDONS & OLIVER, Inc.

HENRY & WRIGHT  
DIVISION OF EMERY MANUFACTURING COMPANY

CANADAIR  
— AIRCRAFT MANUFACTURERS —

MOTCH & MERRYWEATHER

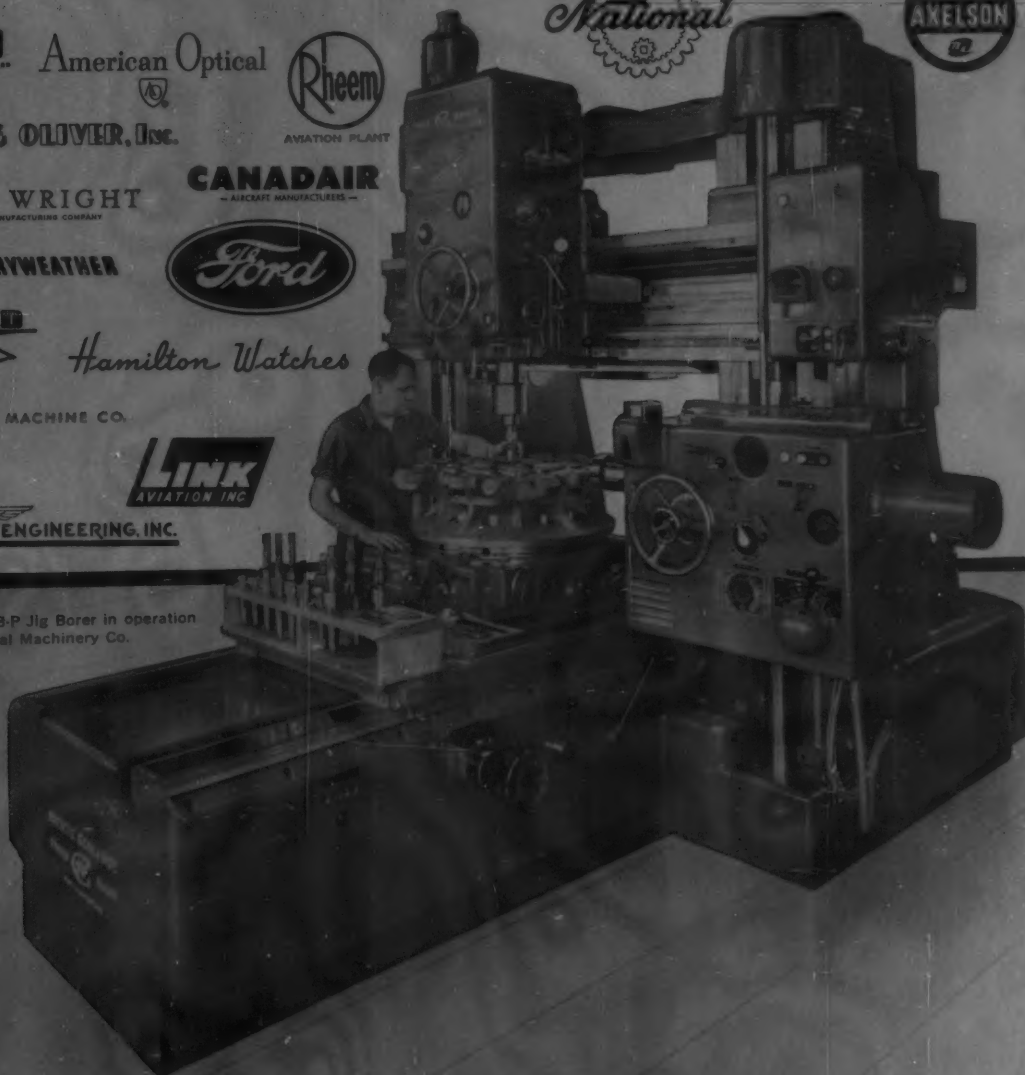


Hamilton Watches

THE Portage MACHINE CO.

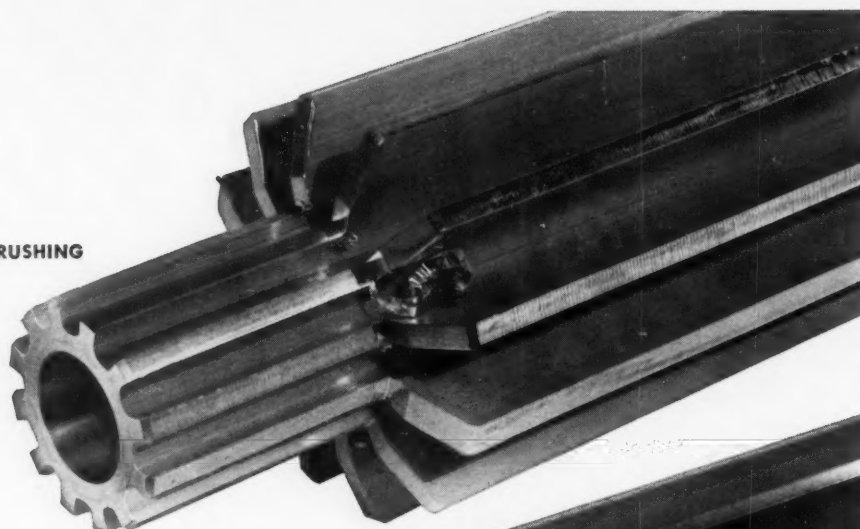


SIP HYDROPTIC 8-P Jlg Borer in operation  
at Hartford Special Machinery Co.

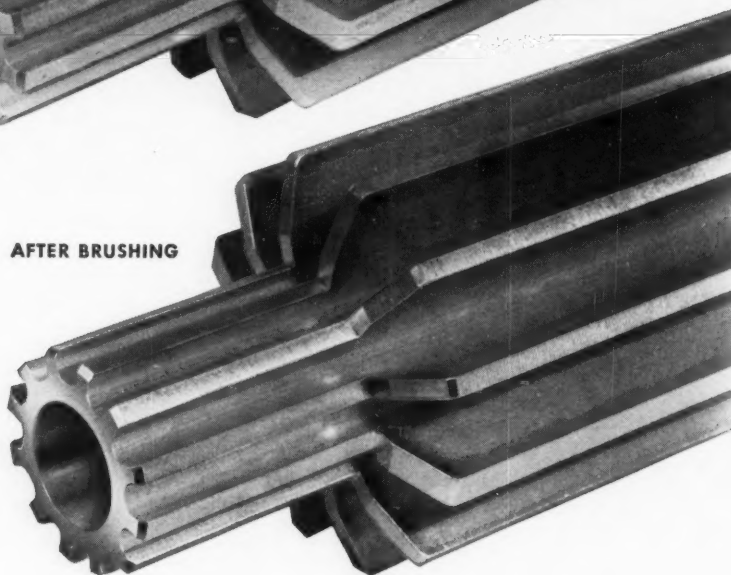


**AMERICAN SIP CORPORATION**  
HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT  
100 EAST 42nd STREET, NEW YORK 17, N. Y.

BEFORE BRUSHING



AFTER BRUSHING



## Quick brush off for burrs

**M**ACHINING this extruded aluminum armature shaft for an aircraft generator turns up heavy burrs. However, Osborn's power brushing method quickly removes burrs and—at the same time—blends all sharp edges.

This is typical of how industry is using Osborn power brushing to improve and speed up thousands of finishing operations.

An Osborn Brushing Analysis made in your plant will show how you can profit from Osborn power brush finishing. Write *The Osborn Manufacturing Company, Dept. D-43, 5401 Hamilton Avenue, Cleveland 14, Ohio.*


# Osborn Brushes



BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES  
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



No. 6 in a series



**THERE'S NO COMPROMISE**

You send print to Cone

Cone makes recommendations

Cone submits samples of your work

You get demonstration of your work and complete job development record

**T**here is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

#### DATA FOR COMPARISON

Part.....	Bushing	Length.....	¾"
Machine.....	1½" Conomatic	Hole Dia.....	1¼"
Tools.....	100% Carbide Tipped	RPM.....	825
Material.....	.8620	Time.....	14.8 Secs.
Stock Size.....	1½"		



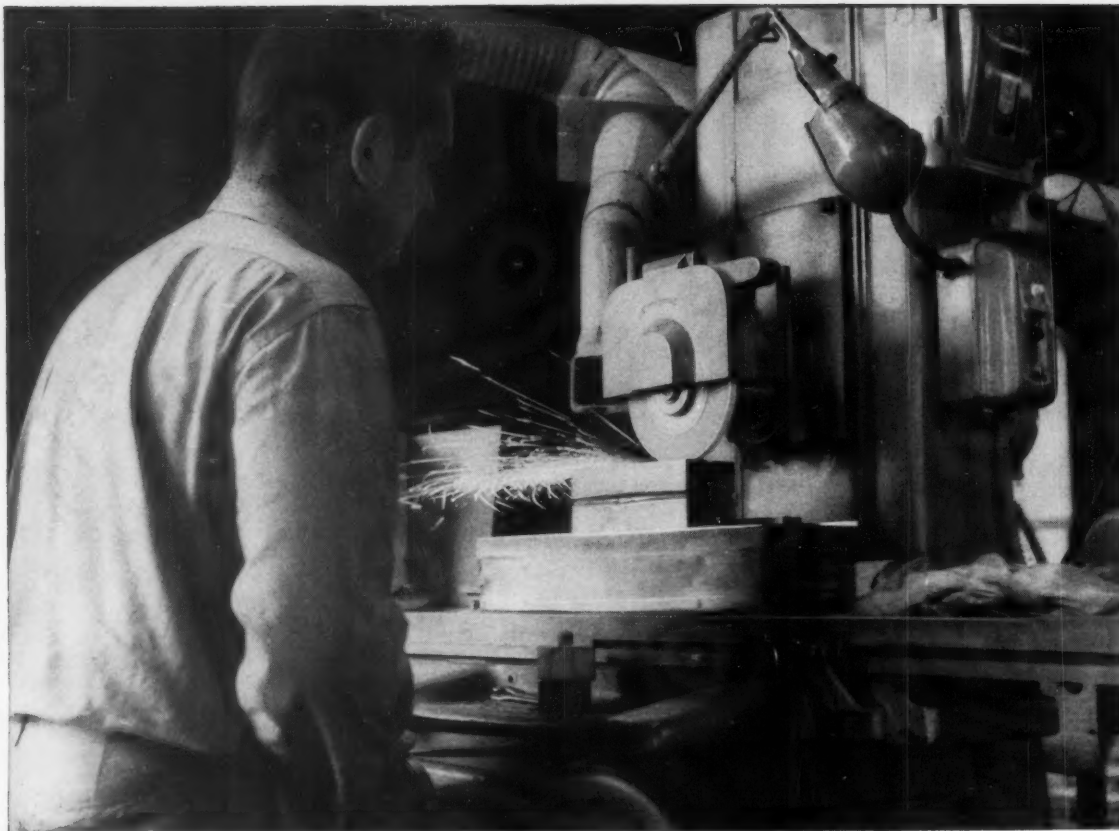
# Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For  
particulars  
send for  
"Four Steps With Cone"

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—123



## "5 years ago Cities Service solved all our lubrication problems and we've never had another!"

A report from Banner Spring & 4 Slide Co., Van Dyke, Michigan

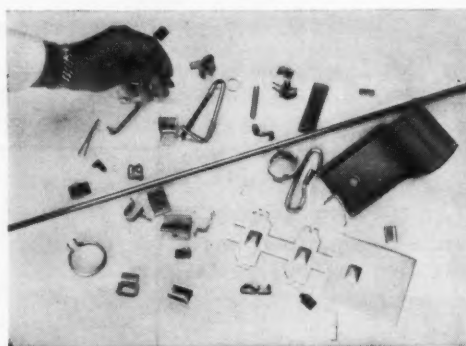
**These Were The Problems 5 Years Ago:** Banner Spring & 4 Slide Company, maker of small parts for the automobile, electrical and refrigeration industries, was having trouble. Ways, bearings, and drive shafts on 4 Slide machines were getting insufficient film strength from lubricants and constantly burning out. Likewise, compressors were also running hot, and there was complete puzzlement over what type of lubricant to use for Banner's high-speed sewing machines.

Banner decided to call in a Cities Service Lubrication Engineer. A thorough survey followed, with the man from Cities Service carefully examining each machine and its particular operating conditions.

This completed, he made his recommendations — Trojan H-2 Multi Purpose Grease for the 4 Slide machines, Pacemaker No. 1 Oil for the compressors, and Pacemaker 00 Oil for the high-speed sewing machines.

Banner followed these recommendations to the letter. Result: Not one lubrication problem in the past five years — despite the fact that machinery runs 24 hours a day!

If you're faced with a lubrication problem — or if you're just not sure if your present lubricant is best for the job — talk with the man from Cities Service. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

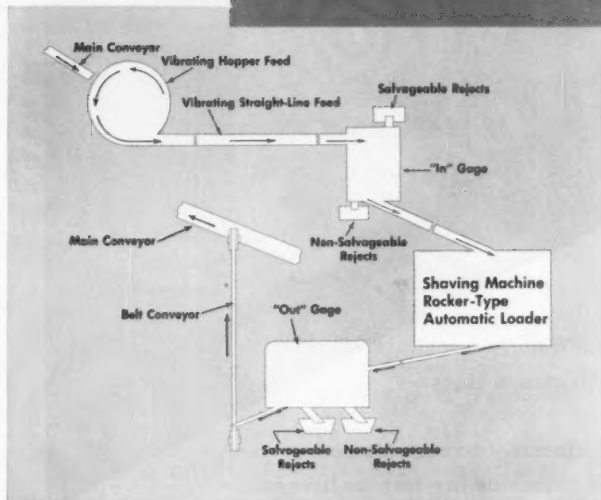
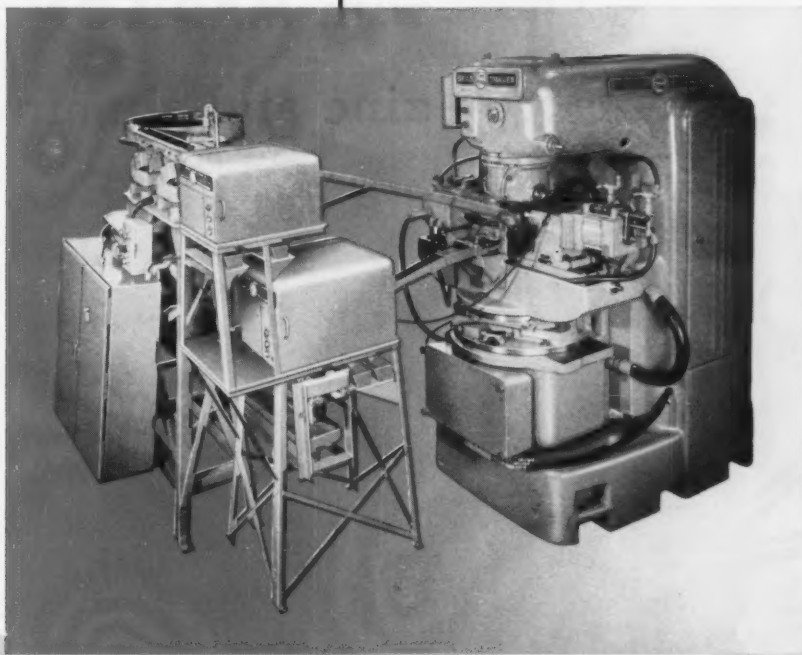


**SOME BANNER PRODUCTS:** The firm makes all kinds of round wire forms, wire springs, metal clips and flat springs. Use for such products ranges from auto fender support rods to "burlap listings"—the wire frames sewn into burlap which back up automobile upholstery.

**CITIES  SERVICE**  
QUALITY PETROLEUM PRODUCTS

**FOR  
MINIMUM COSTS**

# SHAVE GEARS AUTOMATICALLY



*This is fully automatic Red Ring gear finishing.*

Cut gears come in on a conveyor to the storage and feeding mechanism. This may be a vibrating hopper, overhead chute or other device.

These gears are fed into an "In Gage" which screens out undersize and greatly oversize parts, passing only those within tolerance to the Shaving Machine.

After shaving, the gears then go through the "Out Gage" where they are checked for size and helix angle—again screening out the rejects.

Whenever the percentage of rejects goes beyond a selected amount the gage shuts down the shaving machine and indicates by signal lights the nature of the difficulty.

WRITE FOR COMPLETE DETAILS



SPUR AND HELICAL GEAR SPECIALISTS  
ORIGINATORS OF ROTARY SHAVING  
AND ADAPTED TOOTH FORM

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7381

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—125



time tested designing  
with **MADISON-KIPP**  
zinc and aluminum  
die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators. The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

We will be pleased to review your blue prints.

**kipp**

**MADISON-KIPP CORPORATION**  
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

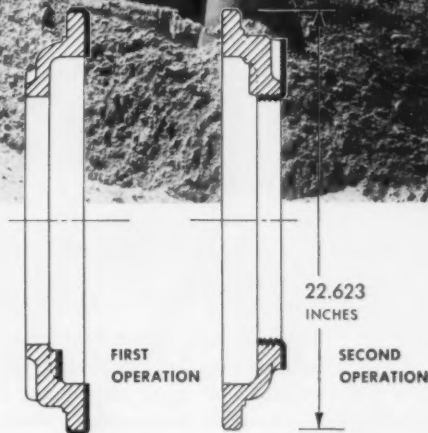
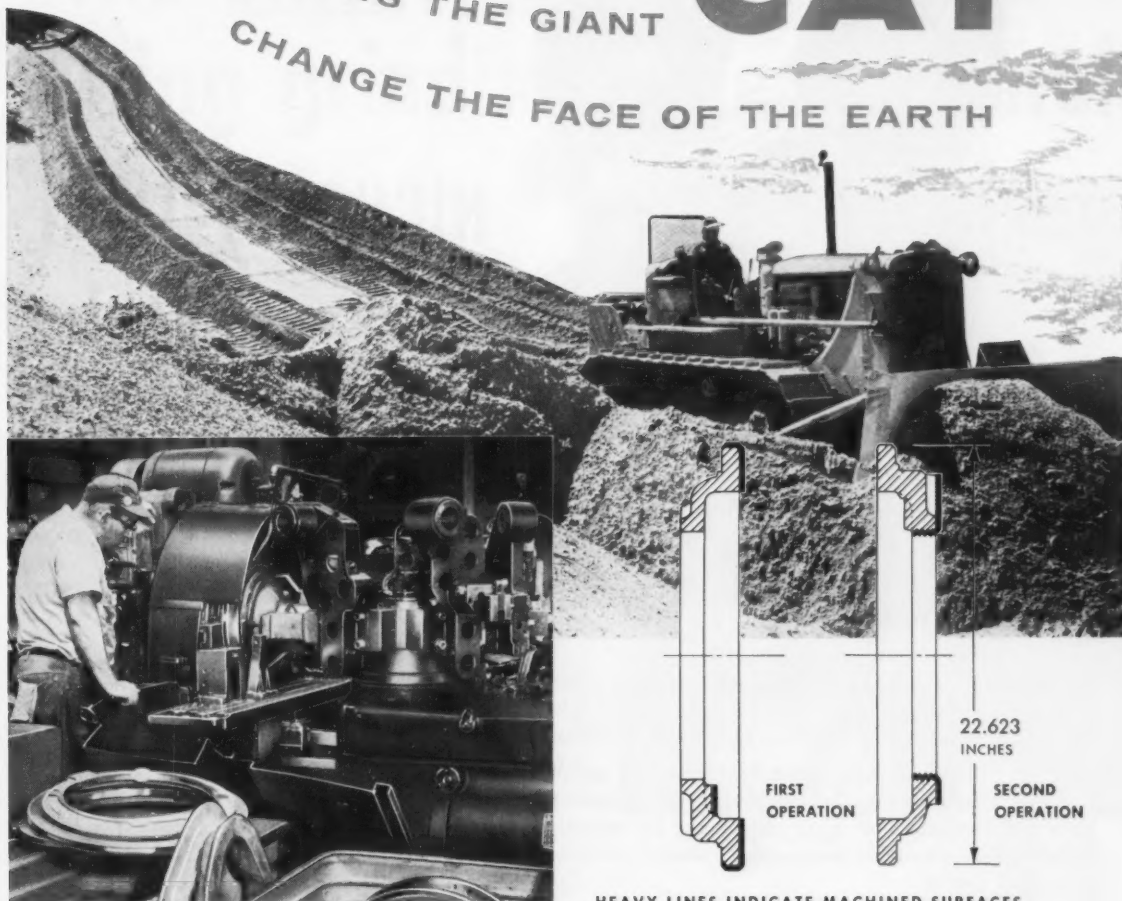
• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools



HELPING THE GIANT

**CAT** \*

CHANGE THE FACE OF THE EARTH



HEAVY LINES INDICATE MACHINED SURFACES

## The POTTER & JOHNSTON 6-DRE-40 Automatic

Chuckling Turret Lathe Produces **BIG** parts like this  
**QUICKLY, ACCURATELY and ECONOMICALLY**

Virtually "changing the face of the earth" is a rough, tough job that takes rugged, built-for-the-purpose equipment like the famous CATERPILLAR Tractors. And turning out component parts for these mighty marvels is a tough job too . . . one that calls for the rugged power, extra rigidity and all-round versatility of a machine like the POTTER & JOHNSTON 6-DRE-40 Automatic Chucking Turret Lathe.

\*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**NAME:** Bracket Flywheel

**MATERIAL:** Steel Casting

**REQUIRED:** 2 Automatic Cycles involving several precision cuts AND A 15 1/2" - 12 N F THREAD!

If you have difficult machining jobs — and who hasn't in these days when complex parts must be produced fast — why not borrow a page from the CATERPILLAR success story. Depend on a POTTER & JOHNSTON AUTOMATIC. Get started today . . . write for full information on the P&J 6-DRE-40 and on the other Automatic Chucking Turret Lathes in the complete P&J line.



Bulletin No. 159

Precision Production Tooling for more than Fifty Years

**POTTER & JOHNSTON COMPANY**

PAWTUCKET, RHODE ISLAND

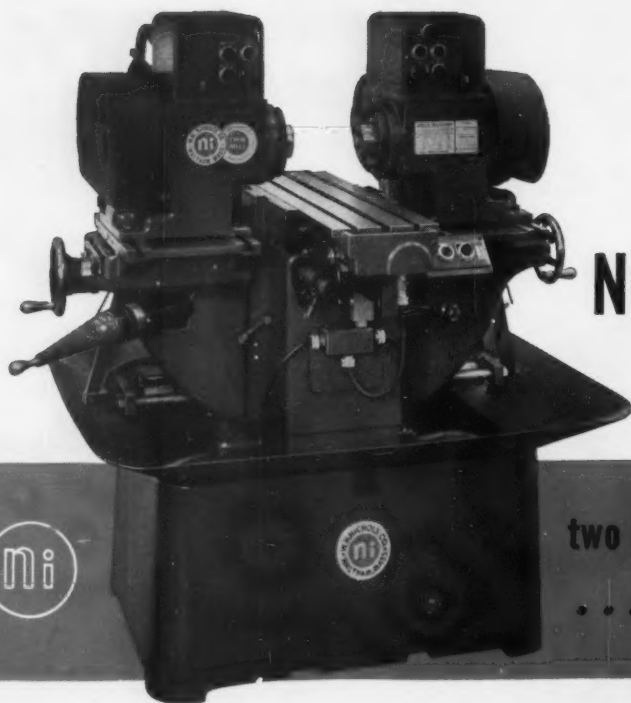
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

P & W BRANCH OFFICES: Birmingham • Boston • Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • New York • Philadelphia • Pittsburgh • Rochester • San Francisco • St. Louis EXPORT DEPT: Pawtucket, Rhode Island AGENTS: Dallas, Southwest Industrial Sales Co. • Houston, Wessendorf, Nelms & Co.

MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—127



# NICHOLS TWIN MILL

two heads are better than one  
....for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using horizontal or vertical spindles.

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

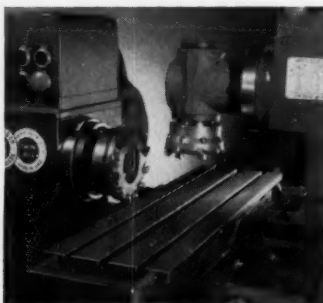
The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

## CONDENSED SPECIFICATIONS

Table, working surface	8 $\frac{3}{8}$ " x 30"
Table Travel—cutting stroke	11 $\frac{3}{4}$ "
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11 $\frac{3}{4}$ "
Max. offset of spindles (horizontal)	8 $\frac{3}{4}$ "
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



76-E Mamaroneck Ave.

NATIONAL DISTRIBUTORS

**NICHOLS-MORRIS CORPORATION**

White Plains, New York



VALVE GATES



PUMP BODIES



HEX NUTS



GUN PARTS



TURBINE BLADES

# The sixth element in your Sterling grinding wheel formula

Five elements normally make up the formula of a grinding wheel—abrasive grain, size, grade, structure, and bond. But, in a Sterling wheel, you can get the *sixth* element.

This *sixth* element is the *human* element. It takes into consideration the important factors that never show up in a grinding wheel specification. These include the operator himself, how he works, and all the "little" things that make *your* grinding job different from all others. And it's surprising how much these factors can mean in money and performance.

To formulate for the sixth element, call in one of Sterling's skilled Abrasive Engineers or your nearest Sterling Distributor. Let him study your complete grinding operation and observe your operators.

Sterling's sixth element can mean big savings to you. Act now!



Grinding 4"-diameter boring-machine spindle.



"Wheels of Industry"—Vitrified and Resinoid—  
to meet the exact requirements of industry.

## STERLING GRINDING

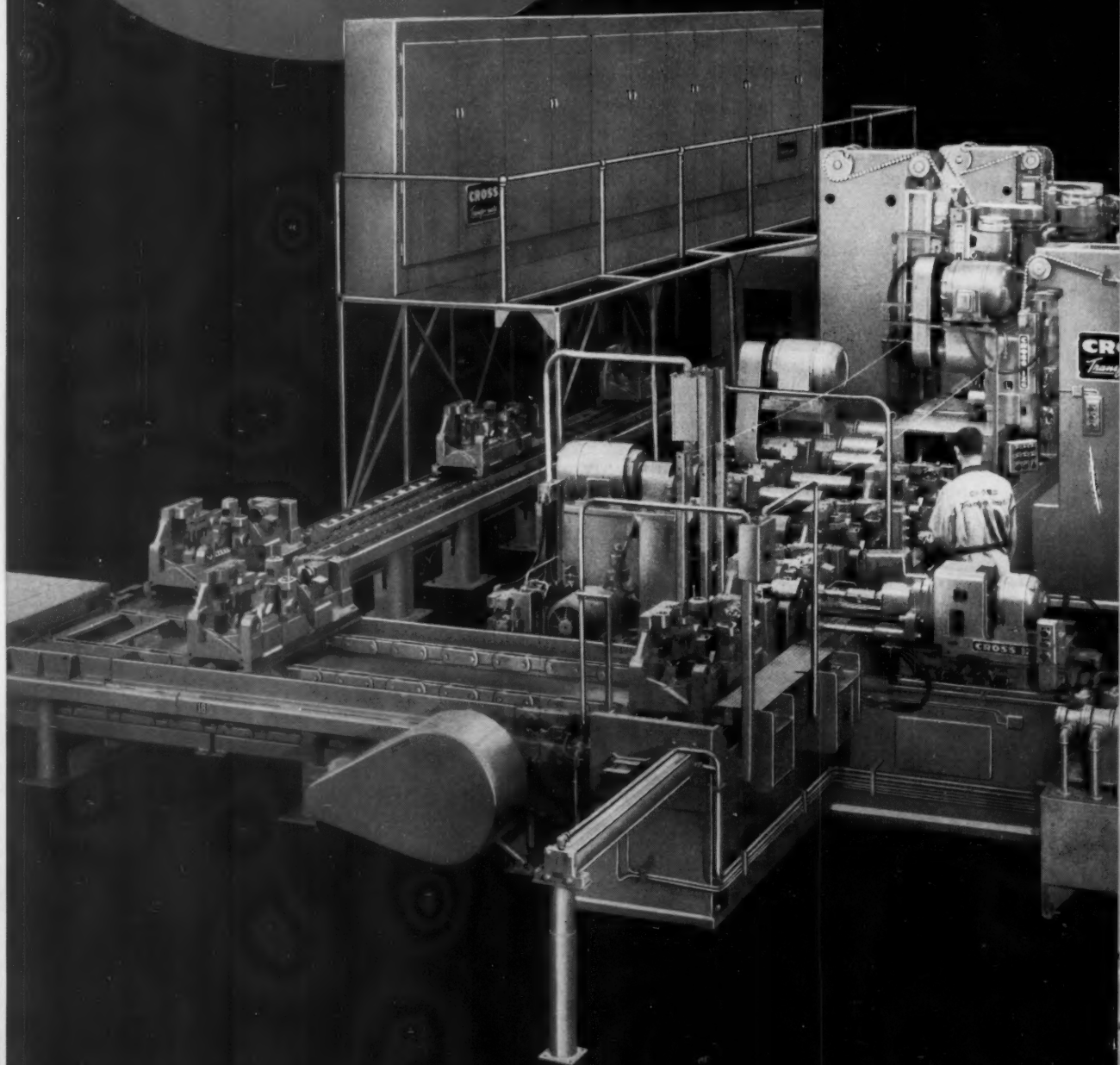


## WHEELS

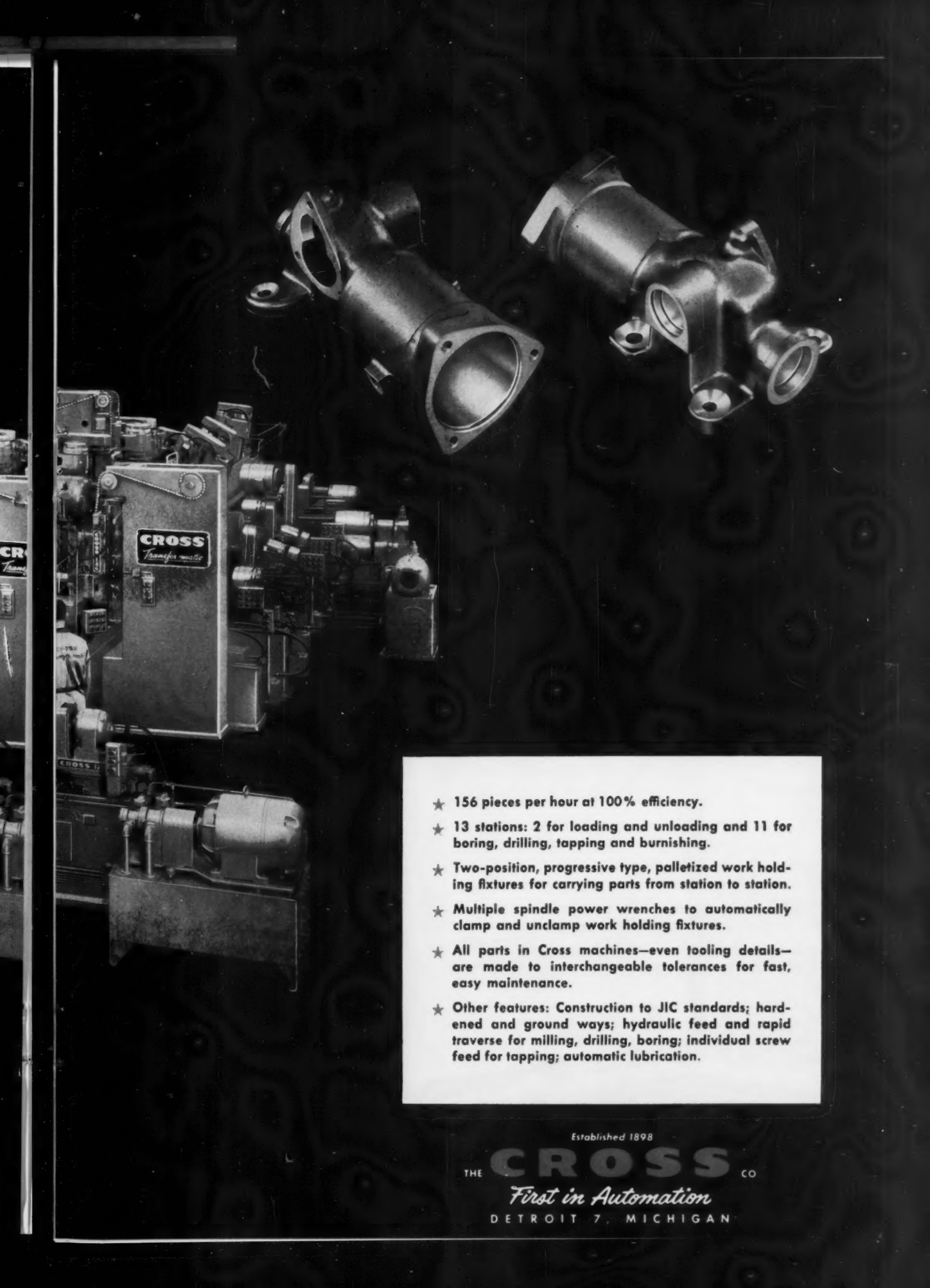
STERLING GRINDING WHEEL COMPANY, TIFFIN, OHIO—SUBSIDIARY OF ABRASIVE AND METAL PRODUCTS COMPANY

**Completely Machines  
Power Steering  
Housings**

*Another Transfer-matic by Cross*







- ★ 156 pieces per hour at 100% efficiency.
- ★ 13 stations: 2 for loading and unloading and 11 for boring, drilling, tapping and burnishing.
- ★ Two-position, progressive type, palletized work holding fixtures for carrying parts from station to station.
- ★ Multiple spindle power wrenches to automatically clamp and unclamp work holding fixtures.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling, boring; individual screw feed for tapping; automatic lubrication.

Established 1898

THE **CROSS** CO  
*First in Automation*  
DETROIT 7, MICHIGAN



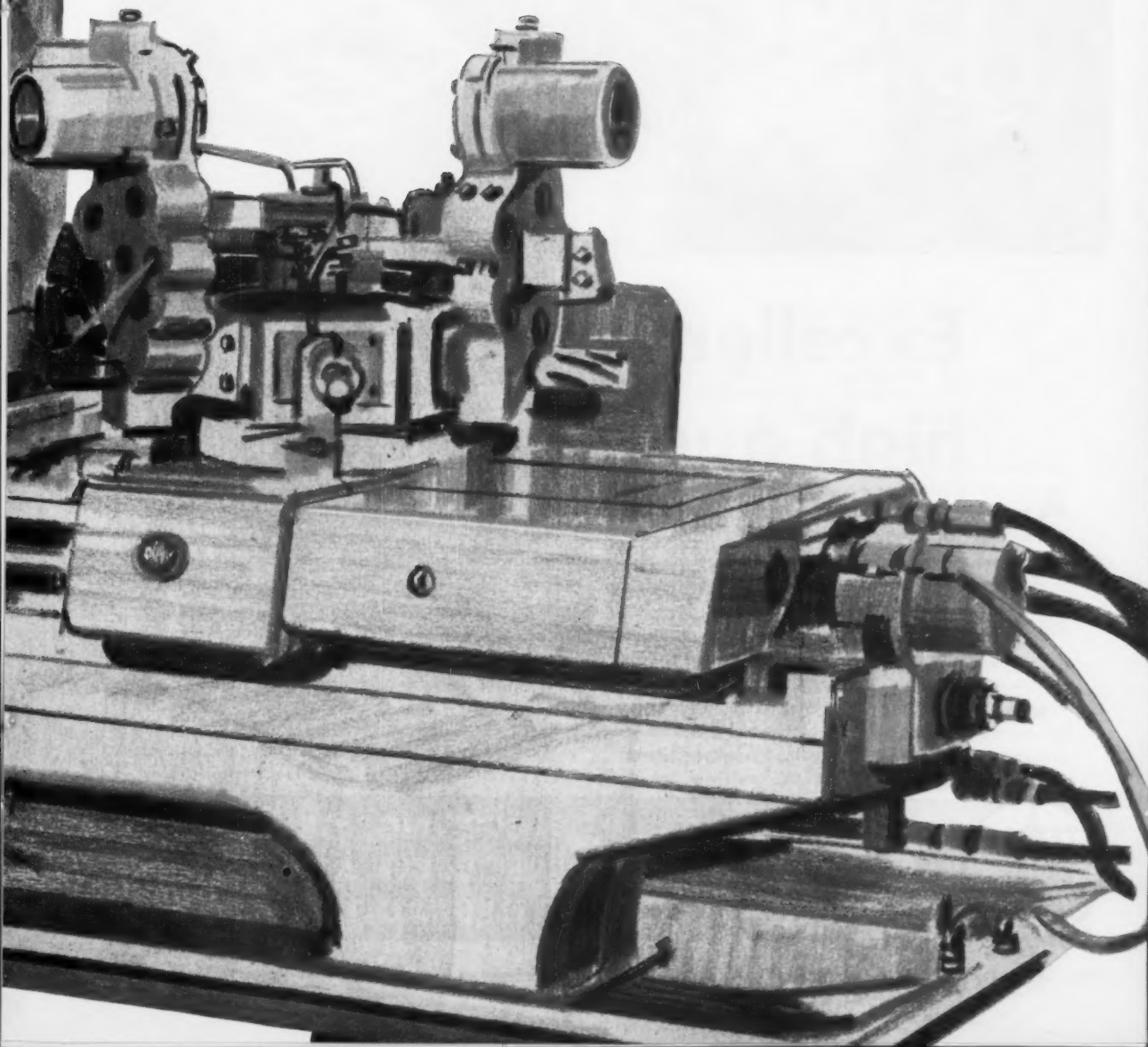
**GISHOLT MASTERLINE  
FASTERMATIC AUTOMATIC  
TURRET LATHE**



This latest design Gisholt MASTERLINE FASTERMATIC Automatic Turret Lathe offers many outstanding features which give you faster, easier operation, higher quality work, quicker setup and lower maintenance. In short, this machine will do your work faster and better at less cost—and with a new minimum requirement for operator skill, effort and attention. May we give you more facts about its profitable application to your manufacturing processes?

Gisholt Machine Company, Madison 10, Wisconsin

*Look ahead—keep ahead—with Gisholt*







## Excellent tool life... high quality threads

**A** prominent nipple manufacturer in Texas (name on request) manufactures nipples from seamless tubing, galvanized pipe and heavy wall tubing—in sizes from 1/8-inch to 8 inches. Landis Dual Head Automatic Threading Machines are used.

Because of the difficult nature of this operation—the manufacture of high pressure, precision fittings—Texaco Lubrication Engineering Service selected *Texaco Sultex Cutting Oil A*—an active sulfur-type oil especially designed for high-speed threading, broaching and tapping. Results have been: excellent

tool life, high quality threads, high production rate.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to enable you to do your machining better, faster and at lower cost. Texaco Lubrication Engineering Service will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N.Y.



# TEXACO

**CUTTING, GRINDING,  
SOLUBLE AND  
HYDRAULIC OILS**



Atoms For Everything . . .

Defense Dilemma . . .

Inflation Maybe?



## Keeping up with Washington

By Loring F. Overman

Rapid expansion of knowledge in the field of nuclear energy should open vast areas of opportunity for industry, including those branches that engineer and produce industry's machines. Whether or not a nuclear weapon is ever used, reports of tests in Bikini and Siberia have exerted a sobering effect on saber-rattlers here and abroad. Industry's Nuclear Energy Committee of One Hundred, which met in New York City, seeks an over-all policy for the use of atomic energy in this country. It intends to make studies of plant safety, insurance, and opportunities in the nuclear field.

Meanwhile, Congress wrestles with proposals for government insurance against third-party claims and has made two legislative proposals for investigating the possibility of nuclear-powered merchant ships. The Atomic Energy Commission has granted sixty-two more permits to private industry for access to atomic information. Under the access permit program, now one year old, 806 permits have been issued.

### Defense Dilemma

The Defense Department's dilemma—exclusive of the annual intra-service wrangle over sharing defense assignments and appropriations—is how to keep pace with improvements sparked by research. Currently, the Navy criticizes the Army for its 100 launching sites for Nike missiles—a type which the Navy says is inferior. The Army counters that the Nike missile at the time of its adoption was the furthest advanced of all missiles. Meanwhile, the Air Force belittles the defense roles of both the Army and Navy.

Congress is to investigate; Defense Secretary Wilson fumes; business wonders; and the machine tool program for defense awaits the outcome.

Solution of this question depends upon four major

factors, according to Dr. H. Guyford Stever, chief scientist of the United States Air Force. He listed the factors as scientists and engineers, facilities, funding, and organization and management. Dr. Stever stressed the importance of long-term research planning—including recruiting of potential scientists and engineers at the high school level.

As far as machine tools are concerned, the Air Force has a new policy. It is scrapping its idea of stockpiling for possible future needs. Instead, its plan calls for an inventory of "the most modern types of machine tools and related equipment." The new policy is outlined in Air Force Regulation 78-24.

### Inflation Maybe?

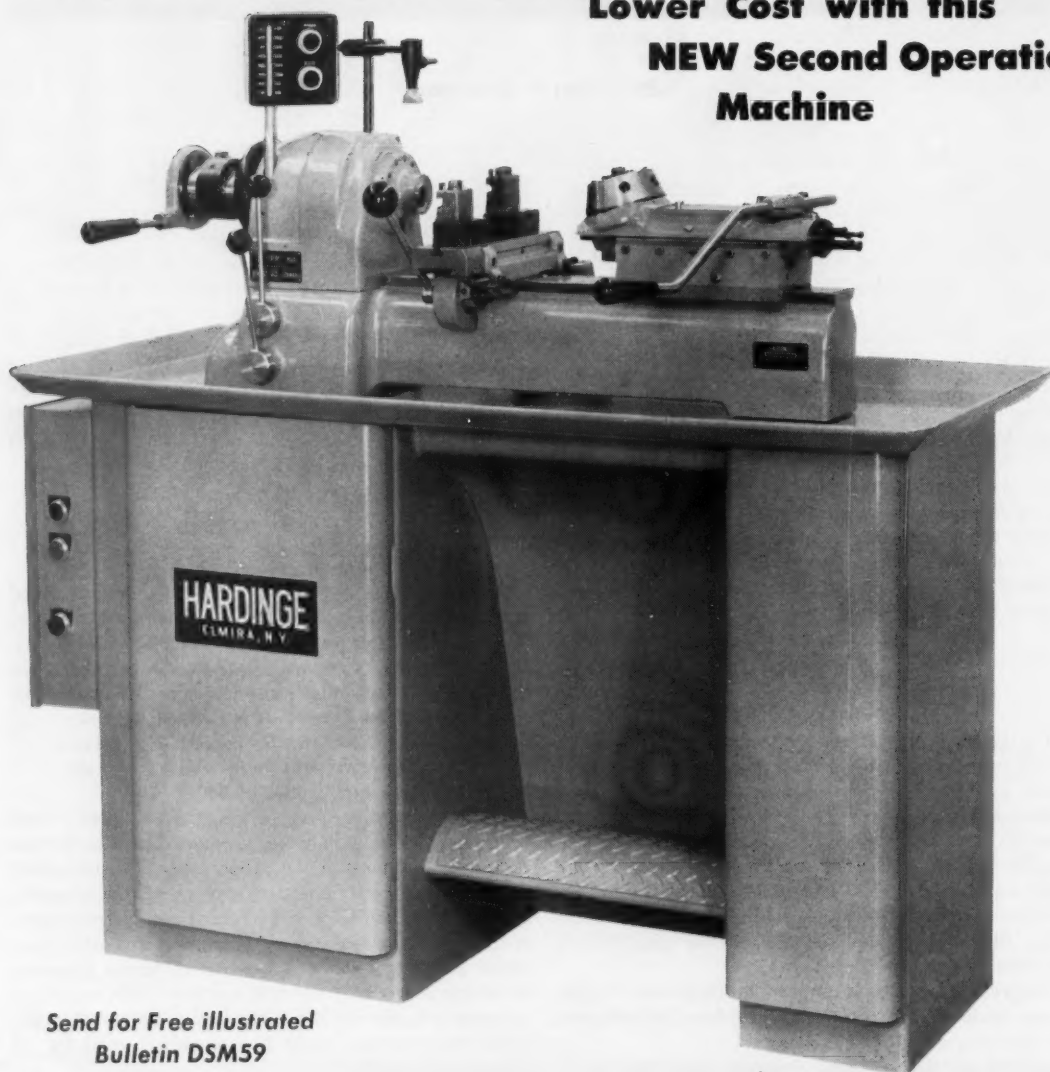
At the business level in Washington, there are mixed reactions to booming industrial expansion, to threatened shortages of metals, to curtailed automobile sales, and a lagging housing program. By all standards, other than the last year or so, today's business outlook is more than optimistic in most lines. This is particularly true in the machinery field. Estimates of industrial plant expansion for this year have recently been adjusted upward from \$35,000,000,000 to \$39,000,000,000.

Despite all the varying factors, the President's chief economic advisor, Arthur Burns, reported on May 22 that prospects are good for the maintenance of a high-level national economy and the staving off of inflation. Possibly the most solid indicator of long-run favorable conditions is the announcement of the United States Steel Corporation plans for a million-ton-a-year expansion program, to be spread out over the next ten years. The expansion program is based solely on population statistics, not defense requirements. Looks like something solid for all industry to build on.



## **Variable Speed Machine for PRODUCTION DEPARTMENTS**

**Produce More Precision Parts at  
Lower Cost with this  
NEW Second Operation  
Machine**



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Bulletin DSM59**

**HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.**

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

## *The Aircraft Industry Always Looks Forward*

ONE does not ordinarily think about the tremendous strides made by the aircraft industry in a comparatively short span of time. Twenty-five years ago, bombers were still being constructed of wooden frame members and covered with fabric. Shortly before the outbreak of World War II, all-metal planes made their appearance and great advances were accomplished in plane design and performance during the war years.

People not directly connected with the aircraft industry felt that the ultimate had probably been attained with the development of the wartime bombers, which had a weight of 66,000 pounds and a top speed of 350 miles an hour. But today, a modern jet-engine bomber weighs over 350,000 pounds and flies in excess of 650 miles an hour. Smaller fighting aircraft fly far in excess of the speed of sound. Fully as great strides have been made in building passenger planes for the airlines. Before long, huge jet-propelled American-built passenger planes will also be dotting the skies.

Close secrecy is maintained concerning the development and performance of guided missiles, but, from the number of plants engaged in the production of missiles and in the process of construction, it is obvious that the aircraft industry is making big advances in this field also.

Modern bombers are constructed of over 100,000 parts exclusive of nuts, bolts, and rivets, whereas World War II bombers required only 30,000 components. Think of what this means in the way of developing new manufacturing techniques! For one thing, it means that the production men of the aircraft industry are fully as busy as the design engineers in keeping up with progress. In at least one plant, big interceptors are being assembled on a constantly moving conveyor line. The planes are being put together in a matter of hours instead of the days formerly required.

Up-to-date manufacturing operations of especial interest to production men in all branches of the metal-working industry are featured in this issue of MACHINERY—our Sixteenth Aircraft Production number. The articles cover a wide variety of subjects, such as the making of form cutters by the electrical discharge process; the cutting of fine-pitch gear-tooth segments that must be accurate within 5 seconds of arc; the production of jet-engine compressor and turbine blades to the extreme accuracy specified for these parts; and the impact extrusion of steel and aluminum pieces.

Production men deserve fully as much credit as the design engineers for the accomplishments of the still rapidly expanding aircraft industry.

*Charles O. Herb*

EDITOR

# NEW COLOR CODE for steel identification

# KEY TO COLOR SYSTEM

## COLOR CARBON STEEL BARS

GREEN	● C1018 • C1020
BLUE	● C1035
YELLOW	● C1042 • C1045
PINK	● C1095

## ALLOY STEEL BARS

PURPLE	● Ledloy (Solid Purple) Lead Added (Purple Dot)	① Under .30 Carbon ② .30 to under .40 Carb. ③ Heat Treated ④ .40 to under .50 Carb. ⑤ .50 Carbon and over
BLACK		⑥ Rycut Series/Lead
WHITE	● C1212 • B1112	⑦ 4100 Series
ORANGE	● C1213 • B1113	⑧ 4300 and 4600 Series
GOLD	● Low Carbon—High Mang.	⑨ 8600 and 8700 Series
BROWN	● Med. Carbon—High Mang.	⑩ 6100 and 9300 Series
RED	● C1213 Acy. Stock (Solid Red) Sp'l. Ground Finish (Half Red)	⑪ Special Ground Finish

## NEW RYERSON STEEL COLOR CODE

1. Single colors are for Carbon and Carbon-Manganese steels. 2. The Carbon colors Green, Blue, Yellow and Pink define Carbon content. 3. Centered dots of these Carbon colors indicate heat treated condition. 4. Other dots identify additional characteristics. 5. Red means Special Ground Finish. 6. Other colors designate related groups of steel. (See key above.)

### AISI-SAE ANALYSES

#### CARBON STEEL BARS

1000 Series	Ground Finish	Screw Stock	Med. Carb. High Mang.
GR C1018 C1020	R C1213-B1113 Acy.	W C1212-B1112	BR C1141
B C1035	R GR C1018-C1025 T.G.&P.	O C1213-B1113	Y C1141 H.T.
Y C1042 C1045	R Y C1040-C1045 T.G.&P.	GD C1117	BR B C1137
PK C1095	R BR C1141T.G.&P. C1141 Acy.	P Lead C1117	

### SPECIAL PURPOSE STEELS

#### ALLOY STEEL BARS

RYCUT SERIES Lead/Free Machining	Add'l. Alloys (Heat Tr.)
P GR Rycut 20	P PK New Rycut 50 Anid. Bychrome
P Y Rycut 40 Anid.	P New Rycut 50 H.T. Bychrome T.G.&P.
Y Rycut 40 H.T.	P GR Rycut 50 Anid. Nikrome M
P Y Rycut 47 Anid.	P GR Rycut 50 H.T. Nitalloy 135 Med.

### ALLOY STEEL BARS

Lead	4100 Series	4300, 4600 Series	8600, 6100 Series
P GR Lead 8620	BR Y 4140-4142 Anid.	W GR 4615 4620	O GR 8620
P Y Lead 4140-42 An.	Y 4140 H.T.	W Y 4340 Anid.	O GR E8615
Y Lead 4140 H.T.	BR Y 4140 H.T. T.G.&P.	Y 4340 H.T.	GD PK E6150 Anid.

### O. H. Screw Stock

GD Rycase
P GR Lead Rycase
P Ledloy

### CARBON STEEL BARS

Med. Carb. High Mang.	Cold Dr. Stress Rel'd.
BR Rytense	BR Y Stress- proof
BR R Rytense T.G.&P./Acy.	BR Y Ryc 46
Y Rycut	

## AIRCRAFT QUALITY ALLOY STEEL BARS

BR E4130 Anid.	BR E4130 Norm.	BR E4130 H.T.	BR E4130 H.T.	BR E4140 Anid.	BR E4140 Norm.	BR E4140 Anid.	BR E4140 Norm.	BR E4140 Anid.	BR E4140 Norm.	BR E4140 Anid.	BR E4140 Norm.	BR E4140 Anid.	BR E4140 Norm.	BR E4140 Anid.	BR E4140 Norm.
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## STEEL PLATES

High Carbon	E-Z-Cut	New E-Z-Cut	High C. E-Z-Cut	Med. H. Full H. Abrasion Resisting	Hi-Strength Low Alloy	E6615
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COPYRIGHT 1956 JOSEPH T. RYERSON & SON, INC.

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## KEY TO COLOR SYMBOLS:

A—ALUMINUM BK—BLACK GD—GOLD O—ORANGE PK—PINK W—WHITE  
B—BLUE BR—BROWN GR—GREEN P—PURPLE R—RED Y—YELLOW

For Stainless steels and other products, see your Ryerson Stock List

## More logical system aids quality control

Accurate identification of steel—always a point of paramount importance with Ryerson—now becomes even more meaningful than before with the introduction of a new system of color marking.

Based on logical groupings of related types of steel, this new Ryerson color code is easy to understand, remember, and use. It strengthens still further the rigid program of quality control that for years has guarded the known high uniform quality of Ryerson Certified Steel.

Here's how the system works:

1. Single colors are used for standard Carbon and Carbon Manganese Steels.
2. The colors GREEN, BLUE, YELLOW AND PINK always define Carbon content.
3. Centered dots of these Carbon colors always indicate the heat treated condition.
4. Centered dots of other than Carbon colors identify characteristics other than analysis, carbon content or the heat treated condition.
5. PURPLE, BLACK, WHITE, ORANGE, GOLD and BROWN each designate a related group of steels.
6. RED marking of any kind always indicates Special Ground Finish.

If you do not already have this new steel identification chart, we will be glad to send a copy (printed in full color) for your Ryerson Stock List. Call or write your nearby Ryerson plant, or write Box 8000-A, Chicago 80, Illinois.

# RYERSON

JOSEPH T. RYERSON & SON, INC.

PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN.  
PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND  
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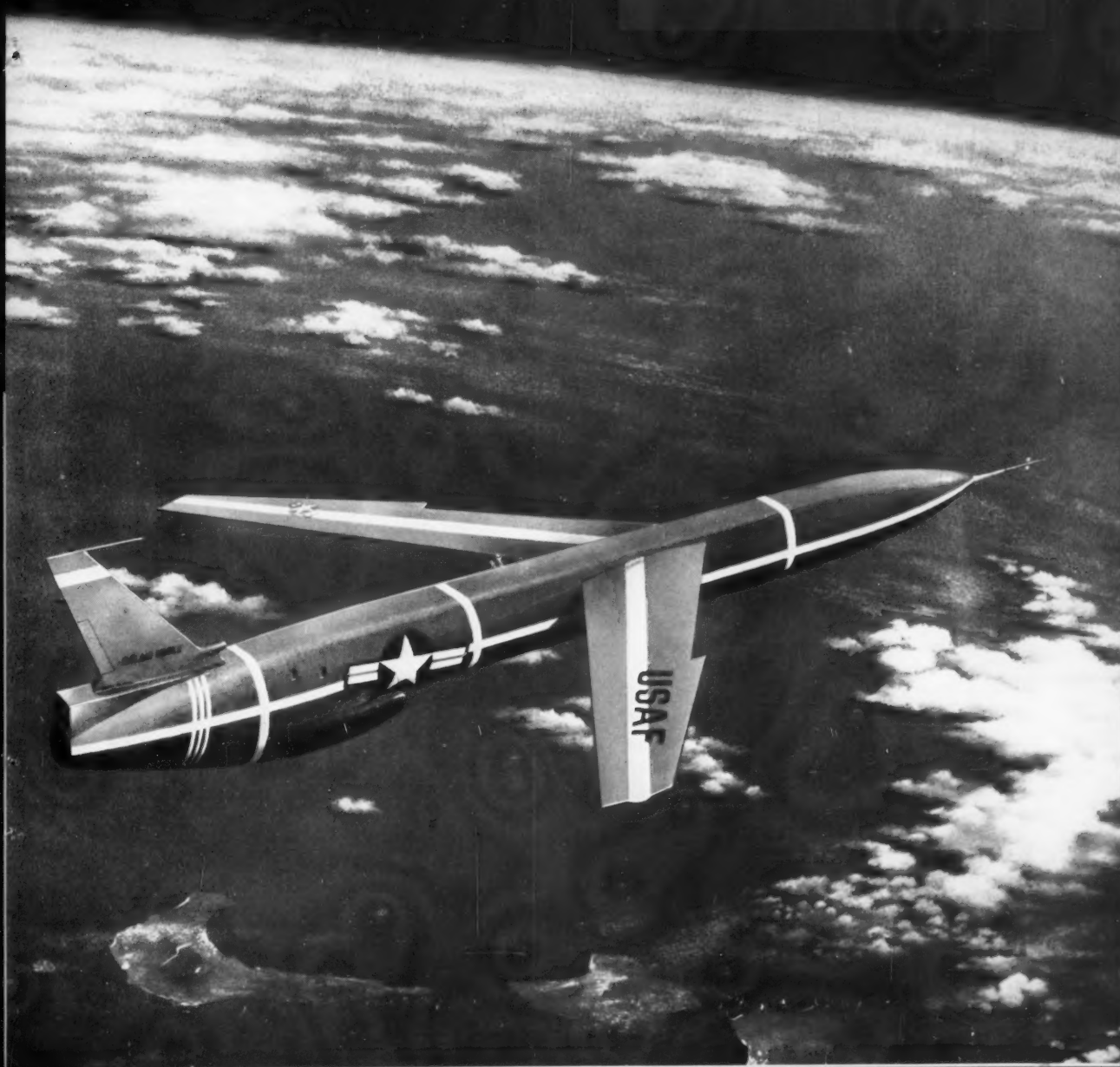


# MACHINERY

Vol. 62 No. 11 July, 1956

USAF Northrop Snark SM-62 Pilotless Bomber

# 16<sup>TH</sup> AIRCRAFT PRODUCTION NUMBER



# FORD JET-ENGINE

## Features Advanced Tooling

By CHARLES H. WICK  
Managing Editor

**New production techniques, improved manufacturing operations, and unique tooling are being employed by the Aircraft Engine Division of the Ford Motor Co. to turn out components for the powerful J-57 turbo-jet engine**

**T**HE most powerful turbo-jet engine known to be in production anywhere in the free world today is being manufactured in quantity by the Ford Aircraft Engine Division at the federal government-owned plant in Chicago, Ill. This J-57 engine is the first in aviation history officially rated in the 10,000-pound thrust class. Addition of an afterburner increases this rating considerably. (One pound of thrust is equivalent to approximately 1 H.P. at a speed of 375 miles per hour.)

While these engines are being produced under a license agreement with Pratt & Whitney Aircraft Division of United Aircraft Corporation, designer of the J-57, the Ford division is a prime contractor to the Air Force. First-line airplanes currently powered by the J-57 turbo-jet engine include the eight-jet B-52 Stratofortress inter-continental bomber, the twin-engine A3D Sky-warrior attack bomber, the F-100 Super Sabre fighter, the F-101 Voodoo twin-engine fighter, the F-102A delta-wing fighter, and others.

One of the most complex parts of the turbo-jet engine is the diffuser case, a precision machined weldment containing eight forgings of AISI 410 corrosion-resistant steel. Starting with 225 pounds of material as the case enters final machining, each completed diffuser case weighs only 185 pounds. The outer case of the diffuser consists of a front and a rear flange that are circumferentially fusion-welded to an outer skin on

the Weltronic automatic machine seen in Fig. 1. Flanges and skin are located on an air-operated expanding fixture, which is mounted on a Sciaky welding positioner that has been specially designed to rotate the uneven mass at a uniform rate with a minimum of backlash.

The Weltronic machine has a traverse arm capable of being rotated through 360 degrees so that as many as four positioners can be spaced around its base. Linde Heliarc or Airco Heliweld automatic heads are mounted on the arm to perform the tungsten inert-gas fusion-welding. AISI 410 stainless-steel wire, 0.062 inch in diameter, is used as the filler metal, and tungsten wire, 0.093 inch in diameter, is used as an electrode to melt the parent metal and filler wire. A mixture of 75 per cent argon and 25 per cent helium is supplied at the rate of 20 cubic feet per hour to shield the weld zone and offer greater sensitivity.

Welding was performed at the rate of 12 to 24 inches per minute, with a direct current of 210 amperes and 12 1/2 volts. By providing a 1/32-inch wide chamfer on the flanges, it was possible to increase the welding speed up to 34 inches per minute with a direct current of 240 amperes and 12 1/2 volts. Previously, this circumferential fusion-welding was performed manually at a speed of only 4 inches per minute. Now, the human element is eliminated and high-quality welds are consistently produced.

The difficult job of cutting elliptical holes for

# PRODUCTION



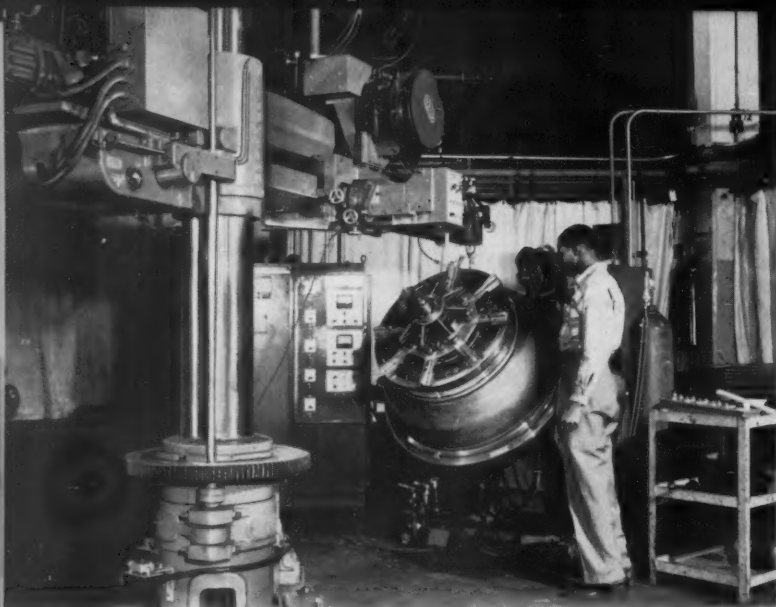
struts in both the inner and outer double-walled shells of the diffuser cases is performed automatically on an Elox two-station, electrical discharge machine, Fig. 2. Eight equally spaced holes are cut through both the inner and outer walls of the shells, which are made from AISI 410 stainless steel and have walls 0.093 inch thick. Contour of the strut holes is held to 0.005 inch of the specified dimensions, and angular location within 1 minute of the required position. Also, corresponding openings in the inner and outer walls must be in line within 0.001 inch.

Diffuser-case shells are clamped, one at a time, on the rotary table of the machine and are automatically indexed to the two machining stations. A slide at each station carries an extruded tubular brass electrode formed to the contour of an ellipse so that its cutting face conforms to the profile of the hole to be cut in the shell wall. The tool at the first station cuts a hole in the outer wall, while the second tool passes through this hole and cuts one in the inner wall. Thus, two holes are being cut simultaneously after the first

hole in each diffuser-case shell has been completed. The tool at the second station is stepped back behind the cutting edge so that it will not disintegrate the outer wall.

Each electrode, or negatively charged tool, is connected to a power pack that supplies 30-ampere, 220-volt current. The work, which is positively charged, and the tools (when they have been advanced to their cutting positions by air-operated slides) are submerged in transformer oil. In cutting, thousands of discharges pass from the tool to the work per second—each discharge removing a small amount of metal. As metal is removed, the gap between electrode and work is automatically maintained by a servomechanism controlled by the voltage across the gap. When the hole has been completed, a limit switch is contacted which causes the air-operated slide to rapidly retract. The table then indexes.

Permanent magnets, mounted inside the hollow electrodes, hold the blanks cut from the shell walls and withdraw them from the work as the electrodes are retracted. Approximately twelve



**Fig. 1. Automatic fusion-welding machine for joining front and rear flanges to an outer skin, thus producing an outer diffuser case.**

minutes is required for each electrode to cut through the 0.093-inch thick wall. However, two holes are cut simultaneously after the first one has been completed. It is hoped to reduce the cutting time to six minutes per hole when 50-ampere power packs are installed.

Precision boring of the forged internal bearing-support members of the diffuser case is performed on the special Cross double-end machine seen in Fig. 3. The diameter of the bore into which the accessory drive-shaft is to be assembled is held to a tolerance of 0.0005 inch, and concentricity is maintained within 0.002-inch total indicator reading. Location of the diffuser case is accomplished from its large diameter flange and a centrally located expanding plug in the work-holding fixture. Also, a spring-loaded pin enters a previously drilled hole.

Quick-change, multiple-blade carbide cutters are mounted on the boring bars at both ends of

the machine. These cutters are changed before making each of the three required cuts, and remove a total of about 1/8 inch of stock in the roughing, semifinishing, and finishing operations. Tools on the left-hand head bore, chamfer, and face one end, while those on the other head simultaneously bore, face, and counterbore the opposite end of the forging.

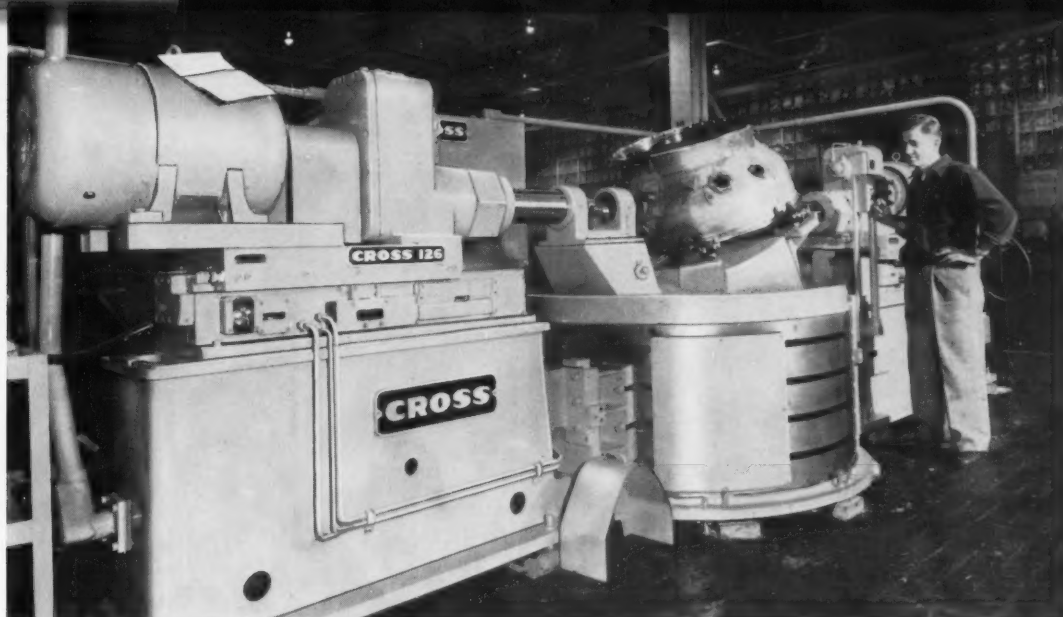
This machine is a good example of the increase in standardization being stressed by Ford so that even special machines can be easily adapted to handle changes in part design or other products. The Cross machine has a standardized center column that permits adding or removing, or changing the radial location of, standard machining heads. The only special part of the machine is the work-holding fixture. Standardization has also been adhered to in the design of the hydraulic units, spindles, and work-heads.

Scallops in the bore of the diffuser-case flange



**Fig. 2. Two-station, electrical discharge machine cuts elliptical holes in both the inner and outer double-walled shells of the diffuser cases.**





**Fig. 3.** Precision boring of diffuser case to tolerances of 0.0005 inch is done on this special double-end machine made from standard components.

are rough- and finish-contour-milled on a special Sundstrand machine, Fig. 4. The diffuser case is located on the rotary table of the milling machine from the periphery of the large diameter flange, with a spring-loaded shot-pin entering a hole previously drilled in the part. Adjustable cams, mounted around the edge of the rotary table, contact limit switches which control the movement of the milling head to produce the required scallop contours. Also, adjustable cams and limit switches located along the side of the head control the length of travel or depth of cut.

Substantial savings have resulted from the use of the Jacy automatic indexing machine seen in Fig. 5 for piercing apertures and airfoil-shaped slots in jet-engine rings, shrouds, and similar

parts. Previously, these operations were performed on 75-ton horn presses, equipped with special indexing devices, punches, and dies, which required about thirty minutes to complete an average part. Now, a similar part can be done in eight minutes.

Any part up to 48 inches in diameter and 36 inches high can be handled on the versatile indexing machine, which was made by Modern Engineering Service Co. The piercing cycle is entirely automatic, with the exception of manual loading and unloading of the work-piece. Dials on control panel are connected to an electronic counter for pre-setting the amount that the hydraulically operated rotary table is indexed. Any number of indexes up to 720 in one complete

**Fig. 4.** Scallops in the bore of diffuser-case flange are contour-milled on this special machine. Cams control movement of head.





*Fig. 5. Indexing machine for piercing jet-engine rings, shrouds, and similar parts. Amount to be indexed is pre-set by dials.*

revolution can be obtained with this set-up.

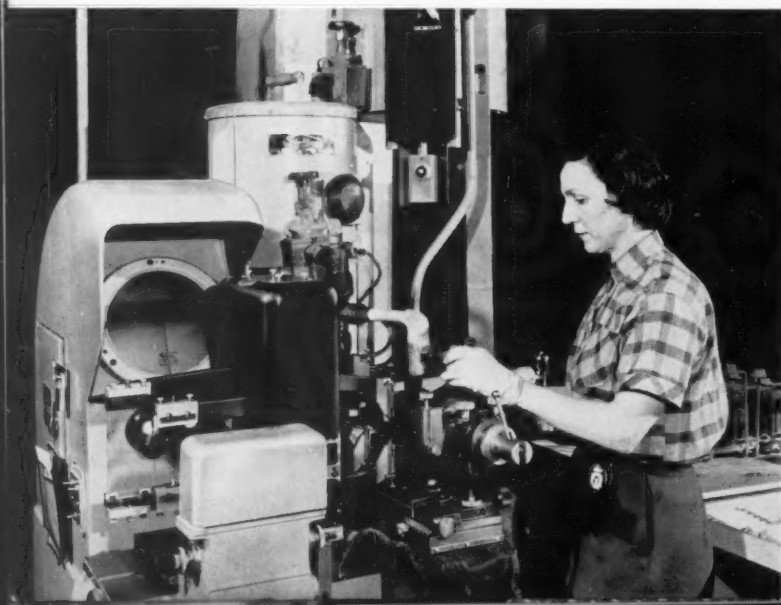
The C-clamp type piercing member is hydraulically operated and can be tilted as much as 30 degrees in a vertical plane to pierce parts having various configurations. Work-pieces fit on an expanding arbor type adapter which is mounted on the rotary table of the machine. A three-prong spider, equipped with rollers, is used to clamp the part against the adapter.

Turbine buckets for the J-57 turbo-jet engine are precision investment castings made from a corrosion- and heat-resistant superalloy—AMS 5382—which is similar to Haynes Alloy No. 31 and contains about 54 per cent cobalt, 25.5 per

cent chromium, 10.5 per cent nickel, and 7.5 per cent tungsten. To insure accurate machining of buckets, they are precisely positioned in shuttle blocks by means of Jones & Lamson optical comparators, such as the one seen in Fig. 6. Then, while still mounted on the comparator, Cerrobend low melting point alloy is poured around the airfoil section—thus forming a matrix which securely retains the bucket in the required position during subsequent machining. After machining, the matrix alloy is melted by dipping the shuttle blocks in hot water (maintained at a temperature of 200 degrees F.), and the buckets are removed.

Prior to casting the matrix, the root end of the bucket is clamped between two manually operated jaws, and tracing styli are passed over the airfoil section of the bucket. Glass plates on which the required airfoil contour has been etched are carried on the opposite ends of the stylus arms. The required and actual contours are projected at twenty times magnification on the large viewing screen of the comparator, and the position of the bucket in the jaws is adjusted until the projections coincide. Then a shuttle block, which has been precision-ground on all four sides to maintain for production requirements  $\pm 0.0001$ - to  $-0.0005$ -inch tolerances, is placed over the bucket. Magnetic shields are placed over the ends of the block and the matrix is cast. The alloy is supplied from a Sta-Warm heater (maintained at a temperature of 180 degrees F.) into which Cerrobend pigs are placed.

Production has been boosted by broaching the fir-tree serrations in the root ends of the turbine



*Fig. 6. Casting device is provided on this optical comparator for pouring low melting point alloy around turbine bucket held in a shuttle block.*

*Fig. 7. Twin-ram, 15-ton, vertical machine for broaching fir-tree serrations in root ends of turbine buckets.*

buckets. Previously, these serrations were ground from the solid. Serrating is done on twin-ram, 15-ton, 100-inch stroke vertical machines made by the Detroit Broach Co. Each machine is equipped with two pairs of work-holding fixtures, with one pair mounted in front of each ram, as seen in Fig. 7. With the bucket-carrying shuttle block hydraulically clamped in the first fixture, both end surfaces of the bucket root are broached as the left-hand ram descends. The block is then rotated 90 degrees and placed in the second fixture for broaching the fir-tree serrations.

Insert type carbide broaches are used on both rams, and good results have been obtained with Kennametal Grade K6 carbide. While a ram speed of 120 surface feet per minute is possible, it has been found more economical from the standpoint of tool life to perform the broaching operations at 18 feet per minute. At present, tool life is in excess of 1200 pieces per grind on the root serration and 4000 on the root ends. Vantrol 5495G, sulphur-base oil, made by Van Straaten Chemical Co., is used as the cutting fluid.

Fir-tree serrations are broached to within 0.015 inch of the required size. Finishing is done on Ex-Cell-O dual-wheel, form-grinding machines. Three shuttle blocks are loaded at a time in a fixture which automatically feeds into position and reciprocates between the two wheels.

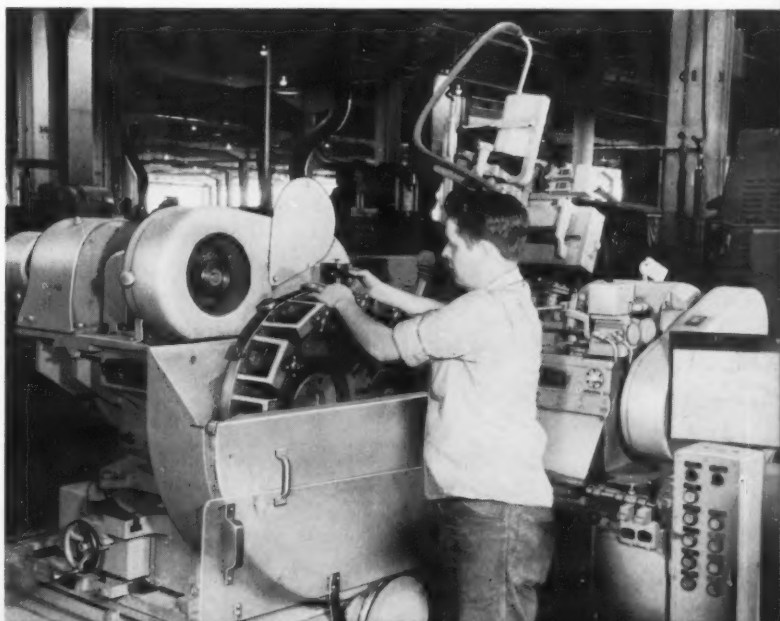
Shroud ends of the turbine buckets are ground to the specified contour on a Norton cylindrical grinding machine, Fig. 8. Originally, the work-holding fixture was of faceplate design with vee type locating blocks having yoke-and-screw lock-

ing devices for holding twelve shuttle blocks. Production has been boosted by redesigning the fixture to accommodate sixteen shuttle blocks and by providing universal quick-acting clamps for faster loading and unloading.

Each grinding machine is equipped with two vitrified-bond, aluminum oxide abrasive wheels 24 inches in diameter and of 100 grain size. The wheels are diamond dressed to produce the required radii and are rotated at 1000 R.P.M., while the work-holding fixture is revolved at 250



*Fig. 8. Shroud ends of turbine buckets are contoured on this cylindrical grinding machine. The rotary fixture accommodates sixteen shuttle blocks.*





R.P.M. From 0.040 to 0.100 inch of stock is ground from the periphery of each bucket, with a feed of 0.002 inch per pass.

One of the most complex machining problems encountered in making components for the J-57 turbo-jet engine was the contour-boring of the long turbine shaft which carries the second- and third-stage turbine wheels and drives the compressor. This shaft, which has an over-all length of 66 7/8 inches and a maximum diameter of 9 3/4 inches at the flanged end, is forged from AMS 6415 steel and has a hardness of 35 to 40 Rockwell C. The rough forging weighs 423 pounds, and the finished shaft, 61.6 pounds—necessitating the removal of 361.4 pounds.

Previously, the rough-, semifinish- and finish-boring of the long turbine shaft was performed in ten different operations on large standard lathes. Roughing required twelve hours; semifinishing, twenty-five hours; and finishing, thirteen and one-half hours—for a total of fifty and one-half hours per shaft. Considerable difficulty was encountered in trying to maintain the required concentricity of the various bores and in obtaining the specified surface finishes. Now, all requisites are easily met by performing the contour-boring on three Wickes center-drive, double-end lathes, such as the one shown in Fig. 9. Also, the cycle has been reduced to six and one-fourth hours per shaft.

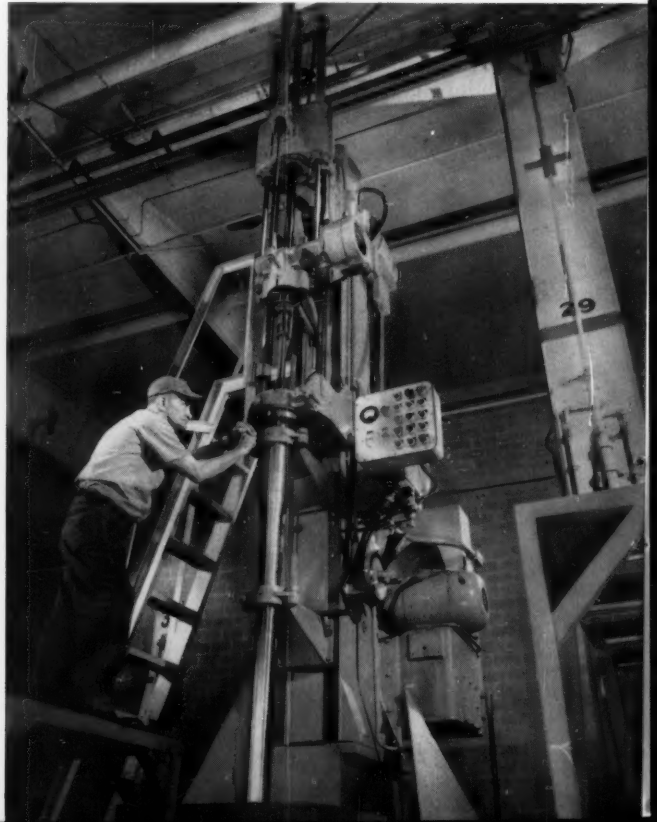
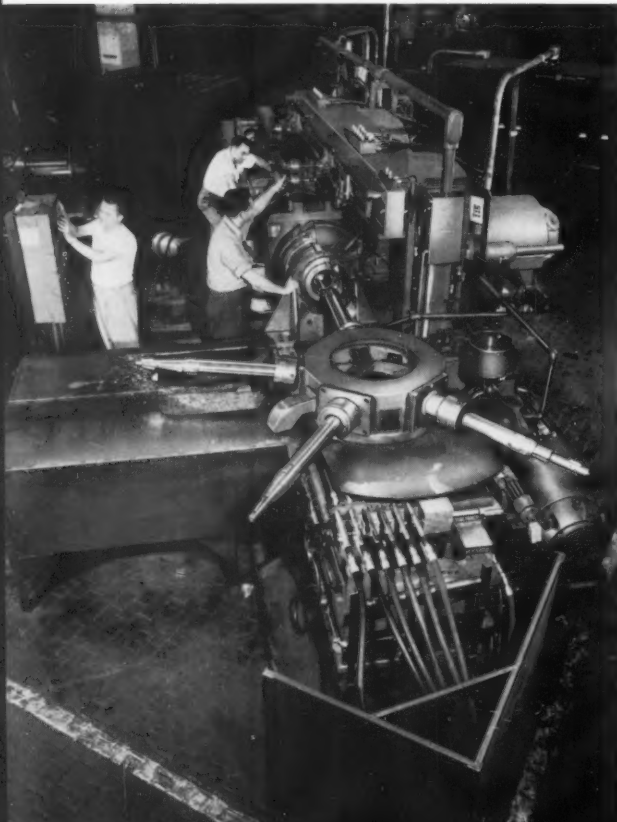
The shaft is clamped by means of four sets of jaws contained in two independent and two universal chucks. These chucks are mounted on a cross-slide which is fed transversely by a Turchan hydraulic tracing unit and templates to produce the desired bore contours. A turret carrying chamfering, facing, and boring tools is mounted on the right-hand head, while a boring bar is mounted on the left-hand head. Both heads are fed longitudinally on fixed center lines. All the cutting tools are carbide and are fed hydraulically.

As much as 1 inch of stock is removed from the shaft bores. In rough-boring, from 0.060 to 0.100 inch of stock is removed in a straight hogging cut. In semifinishing, 0.800 inch more is removed from the 36-inch bottle bore section of the shaft in four contour-boring passes. The forgings are heat-treated after rough machining and stress-relieved after semifinishing.

It is planned to substitute extruded shafts for the forgings. Concentricity of the extrusion can be held to 0.094-inch full indicator reading, whereas the upset forging required a tolerance

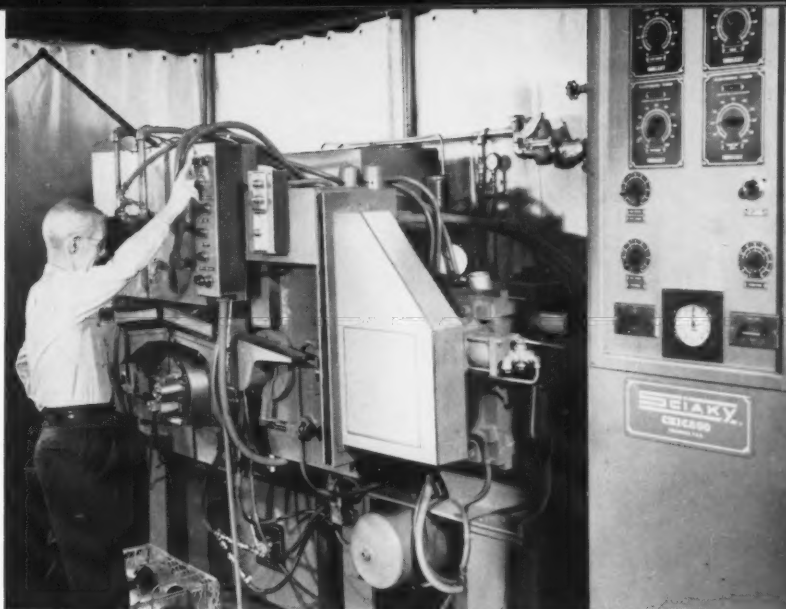
*Fig. 9. Contour-boring of 66 7/8-inch long turbine shaft is performed on this special center-drive, double-end lathe. The shaft is held in four chucks.*

*Fig. 10. Tool marks are removed from bore of long turbine shaft by honing on this 45-inch stroke, vertical machine with 150-grit, aluminum oxide stones.*





*Fig. 11. Flash butt-welder for fabricating combustion chamber liners from 0.050-inch thick by 1.440-inch wide, AMS 5540 nickel-alloy steel strip stock.*



of 0.250 inch. This closer tolerance will make it possible to work with much less machining stock (a reduction of 225 pounds), and the rough-boring operation will be eliminated.

The tremendous torque transmitted by this long shaft during operation of the turbo-jet engine makes it imperative to remove tool marks in the machined bore. This is accomplished on the Barnesdril 45-inch stroke, vertical honing machine seen in Fig. 10. Vitrified-bond, aluminum oxide honing stones of 150 grain size are used to produce a surface finish of 40 micro-inches r.m.s. maximum. Also, the honed surface is maintained concentric with the locating surfaces within 0.003-inch full indicator reading.

Many operating and cost advantages are being realized in the applications of numerous welding machines by using specially designed modifications. Scrap rates are extremely low as the result of having all machine settings done by the set-up man and checked by a quality control representative. Glass doors on the machine are then locked so that the settings cannot be altered by unauthorized personnel. Also, hourly tests are run on each job. The laboratory maintains a record of test results and notifies engineers of any trend which could ultimately result in rejections. In this way, corrections for any deviations are made before scrap conditions develop.

Initially, three resistance-welding machine settings are established for each job, and actual production operations are checked to determine the setting to be used. Tooling is designed to achieve maximum stability of settings combined with a minimum of complexity. All the resistance welders are built with pre-heat and post-heat devices, making it possible to partially heat-treat materials during the welding cycle.

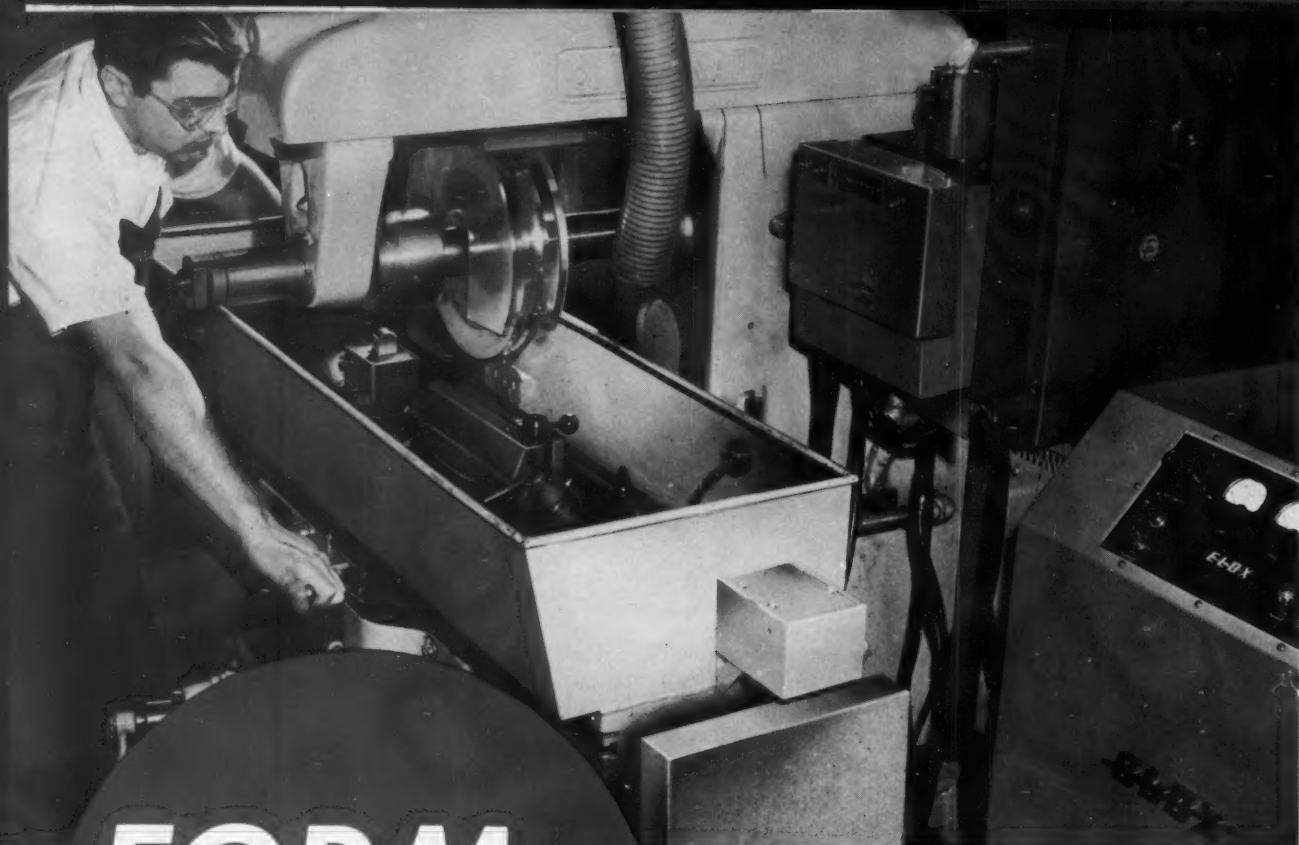
The welding machines are also equipped with rapid-response pressure systems, permitting pres-

sure changes to take place within 0.020 second. Voltage and pressure cut-out units are provided to lock the machine if the voltage or pressure varies beyond pre-set limits. Also, Norgren anti-drift pressure regulators are used to insure that the pressure will not vary from a particular setting during a production run. All machines are individually attached to a completely isolated transformer bank to insure voltage regulation within 1 3/4 per cent.

In conjunction with the extensive automatic welding operations, a recovery system has been installed to conserve the existing supply of cooling water. Without such a system, the welding machines would require approximately 7,000,000 gallons of water per month. The recovery system has reduced this requirement to about 11,000 gallons per month by recirculating the water after filtering. An evaporative cooler has been provided to maintain constant temperature.

Economical fabrication of high-quality engine rings, combustion chamber liners, and similar parts is obtained by flash butt-welding on the Sciaky machine illustrated in Fig. 11. Thin-wall rings that were formerly made by arc-welding in thirty to forty-five seconds can be flash-welded in two seconds. The parts shown being welded are combustion chamber liners made from perforated and roll-formed strip stock (AMS 5540 nickel alloy steel) 0.050 inch thick by 1.440 inches wide.

This Sciaky flash butt-welder has two transformers and is rated at 100 KVA, with 440-volt, 60-cycle current. The part to be welded is clamped by hydraulically operated arms. The left-hand saddle is stationary, while the one at the right travels to bring the blank edges together during welding. A combination of water and air pressure exerts up to 20,000 pounds per square inch to upset and forge the weld area.



# FORM TOOLS

## *by Electrical Discharge Machining*

Complex single-point and form tools of carbide are being manufactured at low cost. Such tools produce improved surface finishes and permit the use of higher speeds and feeds.

By N. P. CICI, Facilities Engineer  
Torrance Location, El Segundo Division  
Douglas Aircraft Co.

**F**OR many years, the disintegrator method of removing metal by means of an electrical spark has been used to remove broken taps, drills, or reamers from expensive jigs, fixtures, and work-pieces. More recently, a similar principle has been combined with precise control in the development of electrical discharge or spark machining.

In electrical discharge machining, intermittent, high-frequency discharges are directed from a negatively charged tool and through a dielectric fluid to the positively charged work-piece. This action removes metal by electro-erosion. The

Torrance Location of Douglas Aircraft's El Segundo Division has adapted this process to the time-consuming and costly production of complex single-point and form tools made from high-speed steel and carbide.

Typical carbide-tipped lathe tools formed by the electrical discharge method are seen along the bottom in Fig. 1, while an experimental thread hob produced in this way is shown at the top. Special convex, radius-forming, carbide-tipped tools made by electrical discharge machining are seen at the left and right in Fig. 2, while multiple-angle, dovetail, carbide-tipped form tools are illustrated in Fig. 3. The high-speed steel masters used to plunge cut the required form into the negatively charged, brass-wheel electrode employed for spark machining are shown at the center in Figs. 2 and 3.

A round nose, carbide-tipped form tool, such as illustrated in Fig. 2, formerly was made in about eight hours. Now, the tool is produced in only approximately two hours by the electrical discharge machining method. Material from the carbide blank, silver solder bond, and parent body metal is removed in one pass. Compared with the high cost of making carbide form tools by conventional grinding methods, spark machining only requires a brass wheel costing approximately \$15. The average wheel can be used to produce from 50 to 80 tools, the exact number depending on the operator's care in redressing the wheel.

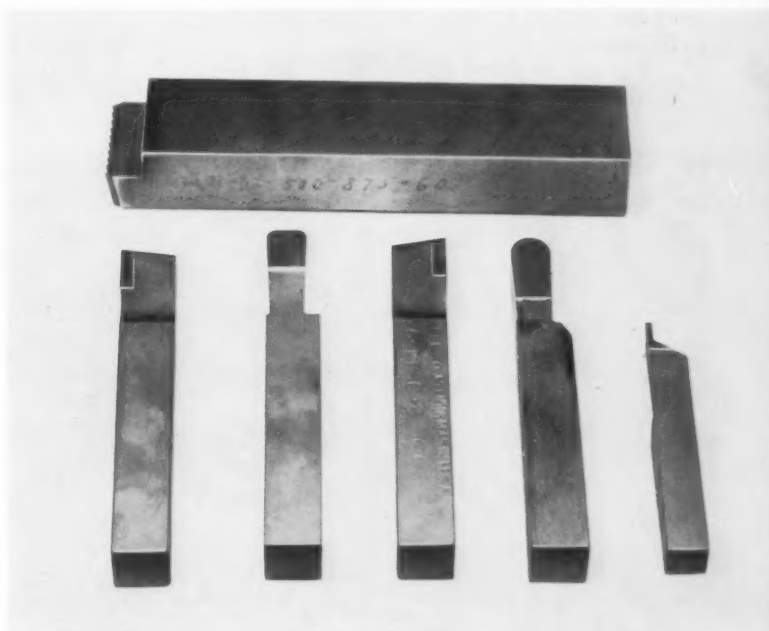
Initial attempts by Douglas at electrical discharge machining made use of a converted tool

and cutter grinding machine equipped with a standard Elox power pack and a commercial brass-wheel electrode, 12 inches in diameter and from 3/4 to 2 inches wide. Among the problems encountered was the fact that the machine spindle was not rigid enough to hold the wheel accurately. Also, precision forms could not be dressed into the wheel, and the table feed was not as constant as required.

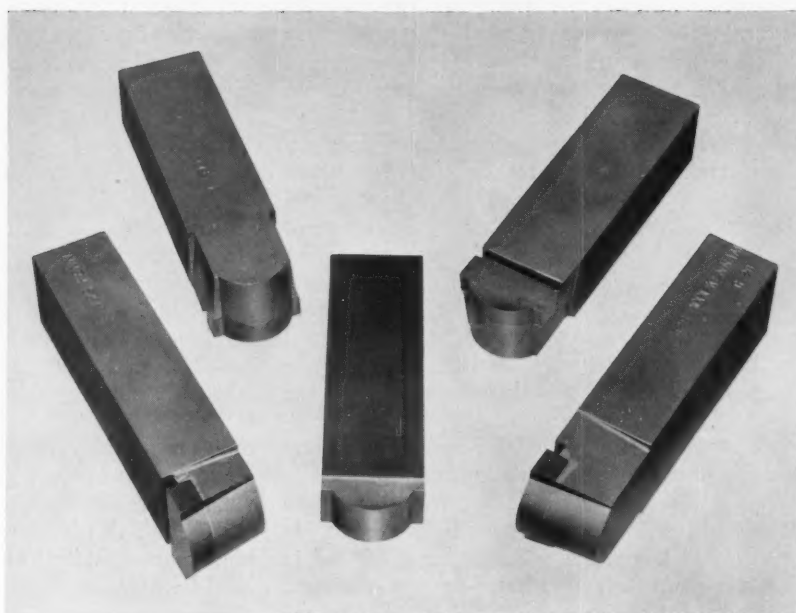
Following numerous tests, the power supply unit and controls were applied to a Cincinnati No. 2 horizontal milling machine, seen in the heading illustration, which provided the greater spindle rigidity required. This set-up worked so efficiently that a second machine has been installed. While all Douglas single-point and form tools are not as yet made this way, the two machines are being used full time and more and more diversified applications are constantly being found. With the increasing demand for higher strength, heat-resistant materials and new hard-to-machine alloys to be used in supersonic airplanes and guided missiles, electrical discharge machining shows even greater promise.

Master tools, usually made from high-speed steel, require approximately four to five hours to be ground to the required shape (an exact duplicate but inversion of the form to be produced on the work-pieces), and set up in a holder on the table of the milling machine. Fig. 4 illustrates the use of a master in plunge cutting or skiving a form into the brass wheel mounted on the milling machine arbor. The master is kept in the holder on the machine table for use in

*Fig. 1. Experimental thread hob (top) and five carbide-tipped lathe tools (bottom) formed by electrical discharge machining.*



**Fig. 2. High-speed steel master (center) is used to cut form in brass wheel for producing convex, radius-forming tools seen at both sides.**



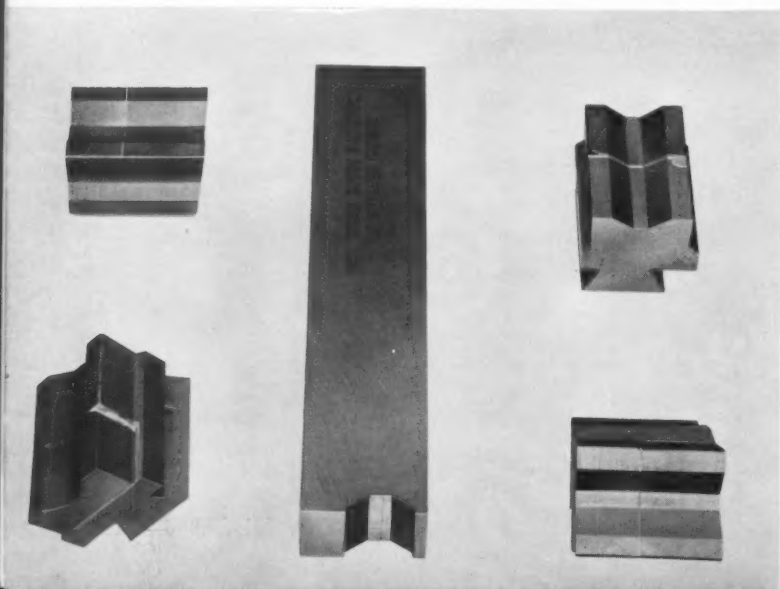
redressing the wheel when required. In redressing the wheel, stock removal is limited to a maximum of 0.005 inch.

Negative charging of the brass wheel is accomplished by passing electric current through the machine spindle and arbor to the wheel. A brass wheel on the back of the spindle, Fig. 5, picks up the current from brushes wired to the power supply unit. With this arrangement, arbors can be quickly changed if required. The power pack is also wired to the insulated table of the milling machine for positive charging of the tools to be spark machined.

Tap switches and control knobs are provided on the panel of the power pack to vary the power

input. Also, a separate control panel is attached directly to the machine and serves as a combination master control and power additive. Toggle switches on this panel are used to connect additional condensers to the circuit, thus increasing the power input for more rapid metal removal in rough machining—with resultant rougher surface finishes.

Feed of the milling machine table is accurately controlled by a servomechanism to precisely maintain the required gap between wheel and work. Traverse is effected by gearing connected to a direct-current motor. During spark machining, the tools to be formed and the lower part of the brass wheel are completely sub-



**Fig. 3. Multiple-angle, dovetail, carbide-tipped form tools produced on modified milling machine seen in the heading illustration. Master is in center.**





*Fig. 4. Master, shown mounted in holder on table of milling machine, is here being used to cut required form in brass wheel to be employed for spark machining.*

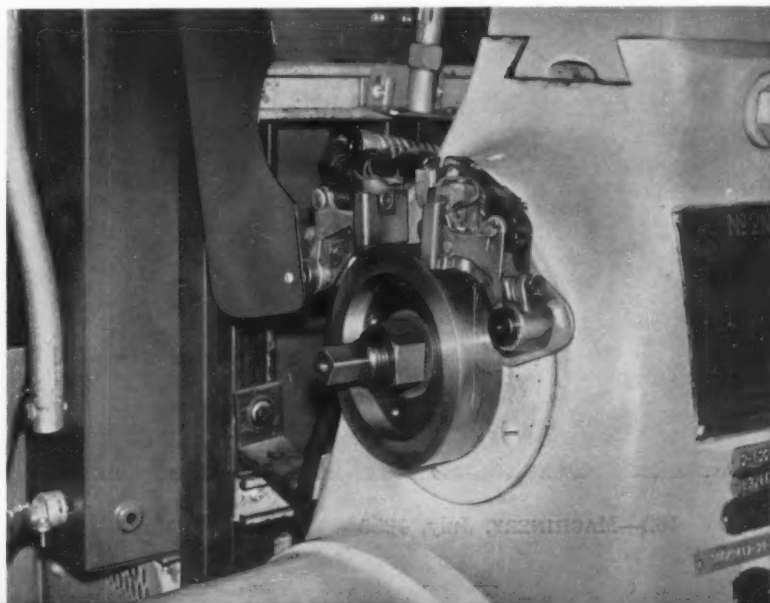
merged in dielectric fluid (transformer oil) contained in a tank mounted on the machine table, Fig. 6. This fluid prevents particles from adhering to the wheel, flushes the particles away from both wheel and work, insures that the electric current is not transferred to the tank walls, and, being a non-conductor, serves to prevent discharges until peak energy has been stored in the wheel. In emptying the tank, the dielectric fluid passes through a filter and into a reservoir located at the left of the machine, Fig. 7. A pump is provided to recirculate the filtered fluid. Various brass-wheel electrodes are stored in conveniently located racks seen at the right.

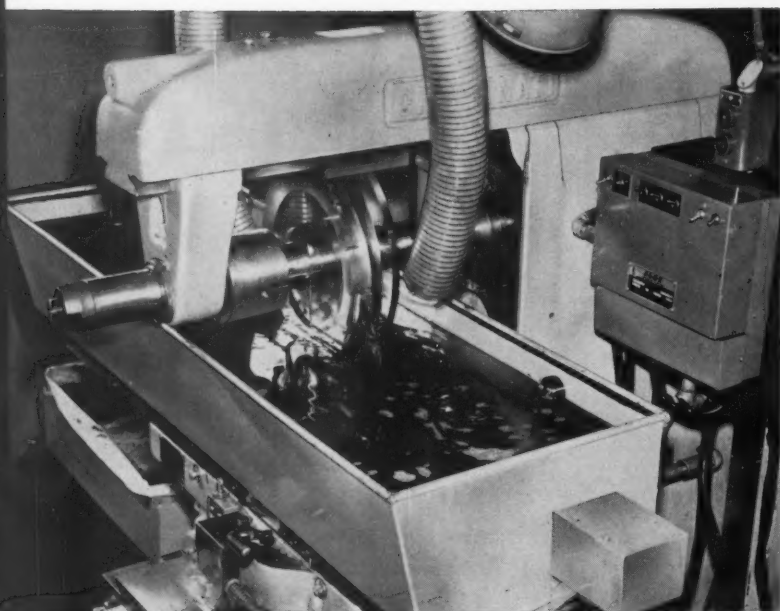
Most of the stock is removed in one pass. How-

ever, the final 0.005 inch of stock is removed in a finishing pass. During electrical discharge machining, both the wheel and work-piece are eroded, in the ratio of approximately 3 to 1. In other words, the electrode wears about 0.003 inch for every 0.001 inch of stock removed from the tools being formed. To maintain the wheel concentric about its axis, it is rotated. Stock removal rate is dependent upon the power input and averages about 0.004 inch per minute.

Since there is no contact, and therefore no pressure exerted by the wheel on the work, elaborate work-holding fixtures are not required. Composite steel-carbide tools are clamped with sufficient pressure on standard magnetic chucks

*Fig. 5. Brass wheel on back of milling machine spindle picks up current from the brushes and transmits it to brass wheel mounted on arbor of machine.*





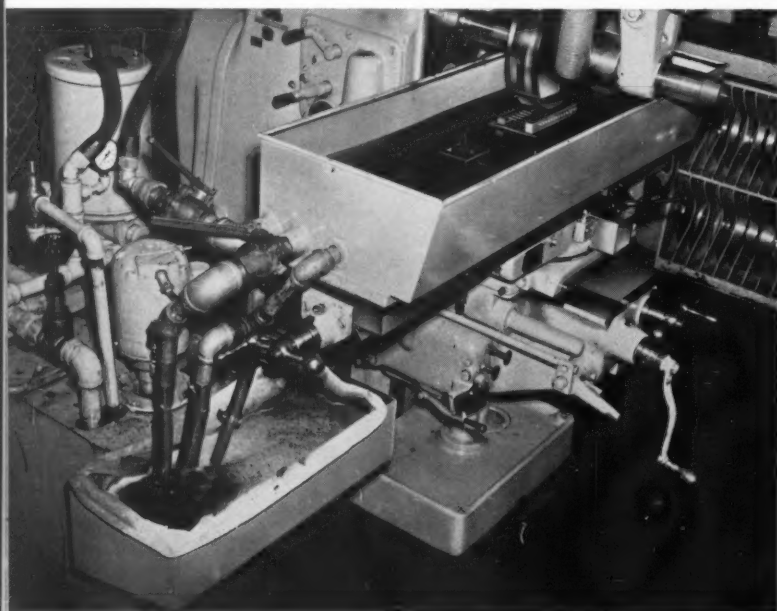
*Fig. 6. During electrical discharge machining, the tools being formed and the lower part of brass wheel are submerged in transformer oil.*

mounted on the milling machine table. Fig. 8 illustrates two fixtures set up on a Brown & Sharpe adjustable angle magnetic chuck for producing the required compound angles on carbide boring bits. All angles are formed with the single flat rim wheel.

In addition to the savings effected and the faster production possible, other major advantages gained with tools formed by electrical discharge machining are that the tools can be oper-

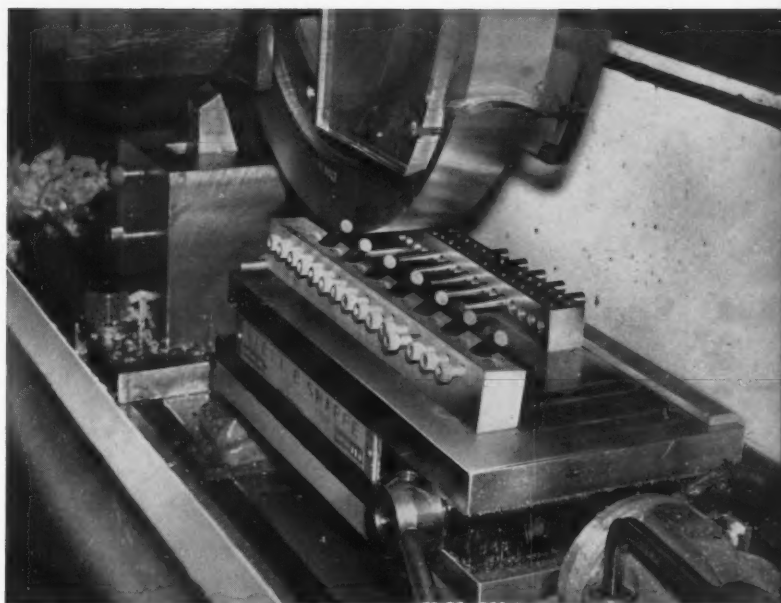
ated at higher speeds and feeds, and smoother surface finishes have been produced on the workpieces. Also, the tools have a longer life, and close tolerances can be maintained with highly repetitive accuracy. One reason for these advantages is that the surfaces of carbide tools formed by spark machining have practically no heat checks or minute cracks.

In one instance, carbide tools are being used on a Warner & Swasey No. 3 turret lathe to turn



*Fig. 7. A filter, reservoir tank, and recirculating pump are mounted at the left of the machine. Storage rack for brass wheels is seen at the right.*

*Fig. 8. Adjustable angle magnetic chuck holds two fixtures filled with boring bits. Flat rim wheel forms required compound angles.*



a 1-inch diameter shaft made from AISI 4140 steel bar stock that has been heat-treated to attain a tensile strength between 180,000 and 200,000 pounds per square inch. The operation consists of turning a 1 1/2-inch long section of the shaft to a diameter of 0.750 inch, and another 1-inch length to 0.500 inch in diameter. With conventional ground carbide tools, the operation was performed at 920 R.P.M. with a feed rate of 0.004 inch per revolution, and the tools had to be reground after producing about 65 parts. When carbide tools formed by electrical discharge machining were substituted, the speed was increased to 1480 R.P.M. and the feed rate boosted to 0.006 inch per revolution. Also, 110 parts can now be turned before the tools need re-forming.

On another job, speed was increased from 564 to 920 R.P.M., and the feed rate from 0.004 to 0.007 inch per revolution. Previously, only 36 parts could be produced before the carbide tools needed regrinding, while now, 84 pieces are completed before re-forming. In this operation, also performed on a Warner & Swasey No. 3 turret lathe, AISI 431 stainless steel bar stock,

3/4 inch in diameter, is turned to a diameter of 0.240 inch by 1 3/4 inches long.

A similar stainless steel bar, 2 1/2 inches in diameter by 8 inches long, is turned to a diameter of 2 1/4 inches for a length of 7 inches on a Jones & Lamson No. 5 turret lathe. Carbide tools formed by electrical discharge machining, and fed at the rate of 0.011 inch per revolution with the work rotating at 1500 R.P.M., complete approximately 176 work-pieces before re-forming is necessary. Conventional carbide tools used to be fed at the rate of 0.006 inch per revolution with a work speed of 504 R.P.M., and only 32 parts could be finished before regrinding.

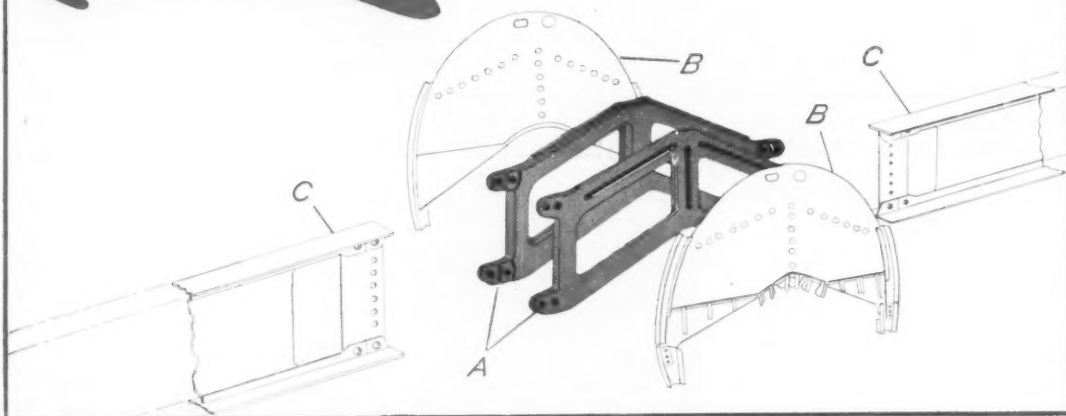
Stainless steel tubes 2 inches in diameter and having a wall thickness of 1/2 inch are turned to a diameter of 1.730 inches by 5 1/4 inches long on a Warner & Swasey No. 1A turret lathe. Spark machined carbide tools can complete 46 tubes between formings, with the work rotating at 684 R.P.M. and the tools fed at the rate of 0.006 inch per revolution. The number of parts previously finished before regrinding the tools was only 19. Also, the speed was limited to 218 R.P.M., and the feed, 0.004 inch per revolution.

Martin  
RB-57

# MARTIN LIGHT BOMBER Hangs on "Garden Gate"



*Fig. 1. Exploded view of "garden gate" fitting showing frames (A) and webs (B). Location of fitting within the fuselage is shown in sketch at left.*





Many interesting operations are being performed in the fabrication of the "garden gate" fitting, or center-section spar assembly, for the various models of B-57 jet-powered aircraft. Being heavily loaded structural members, the spar components are machined from rolled aluminum plates, but only after the quality of each plate has been ascertained through laboratory tests.

By **RAYMOND H. SPIOTTA**

Associate Editor

**R**OUND-THE-CLOCK tactical bombing at speeds in excess of 600 miles per hour and aimed at the destruction of surface military targets is the primary mission of the B-57 light bomber. Equipped with two Wright J-65 jet engines, each developing 7200 pounds of thrust, the plane has a range of more than 2000 miles and can operate at a service ceiling higher than 45,000 feet. The Glenn L. Martin Co., Baltimore, Md., is currently producing this plane in quantity for delivery to the Tactical Air Command of the United States Air Force.

One of the most heavily stressed members of the airframe is the center-section spar assembly. It is shown in the exploded view in Fig. 1. Called a "garden gate" fitting, this assembly is of sandwich type construction consisting of two frames A and two web sub-assemblies B. When the wings are assembled to the fuselage, the ends of the main wing spars C are bolted between the projecting

ears of the frame members. The location of the center-section spar within the fuselage can be seen in the sketch of the aircraft in the upper left-hand corner in the illustration.

Frame members are machined from the solid. They start off as 4- by 8-foot rolled plates of 7075-T aluminum. A reinforced sheet-metal template, having a series of small holes punched through it to conform to the outline of the part, is placed on top of the 4-inch thick plates. Blue dye is then sprayed through the holes in the template, Fig. 2, outlining the frame on the aluminum plate in rows of blue dots.

Six specimens, two for each of three tests, are cut from the slab before any additional work is performed. All the specimens, together with the slab, are tagged for identification purposes. The samples are laboratory tested to make certain that the material will withstand the heavy loads that it will be required to bear.

*Fig. 2. A template having rows of small holes outlining the contour of the frame is placed on top of an aluminum slab. Blue dye is then sprayed along the row of holes.*





*Fig. 3. After the frame has been outlined with blue dye, the slab is placed on a special roller-equipped band-saw table and is rough-sawed to the marked contour.*

Upon receipt of a satisfactory test report, the slab is lifted by a trolley crane and placed on the table of a DoALL band saw, Fig. 3. The table has been especially constructed to facilitate manipulation of the work while cutting along the blue lay-out lines. It is composed of two sections: the square table of the machine itself on which approximately forty rollers have been mounted and a crescent-shaped auxiliary table containing approximately 175 rollers. The entire outline of the frame is roughed out at this point.

Finish machining of the over-all contour of the frame is performed out-of-plant. The part is

brought to blueprint tolerances, except for the mounting ears, on a Cincinnati Hydro-tel.

After being returned to the plant, all surfaces adjacent to the four mounting ears are polished to a finish of 63 micro-inches r.m.s. to eliminate any stress-raising surface defects. The frame is then heated prior to straightening. It is lowered into a tank of oil as shown in Fig. 4. The workpiece is soaked in the oil, which is maintained at a temperature of 220 to 240 degrees F., for a period of time ranging from one-half to three hours. It is then removed and straightened on a Lauto-matic hydraulic press, Fig. 5.



*Fig. 4. Each frame is heated in an oil bath before undergoing a straightening operation. The oil is kept at a temperature ranging from 220 to 240 degrees F.*

*Fig. 5. After soaking in a heated oil bath, Fig. 4, for one-half to three hours, each frame is supported on the table of this hydraulic press and straightened.*



Two wing-spar fitting holes in each of the four ears and the holes to be used for bolting two frames together when forming the sandwich assembly are drilled under size on a Webo radial drill press. The frame is positioned and clamped on a special work-table that forms the lower part of a drill jig, Fig. 6. A rail on either side of the table carries rollers that support the bushing plate. The plate is rolled away from the drill press when the work is being loaded and unloaded, and is rolled back in place for drilling.

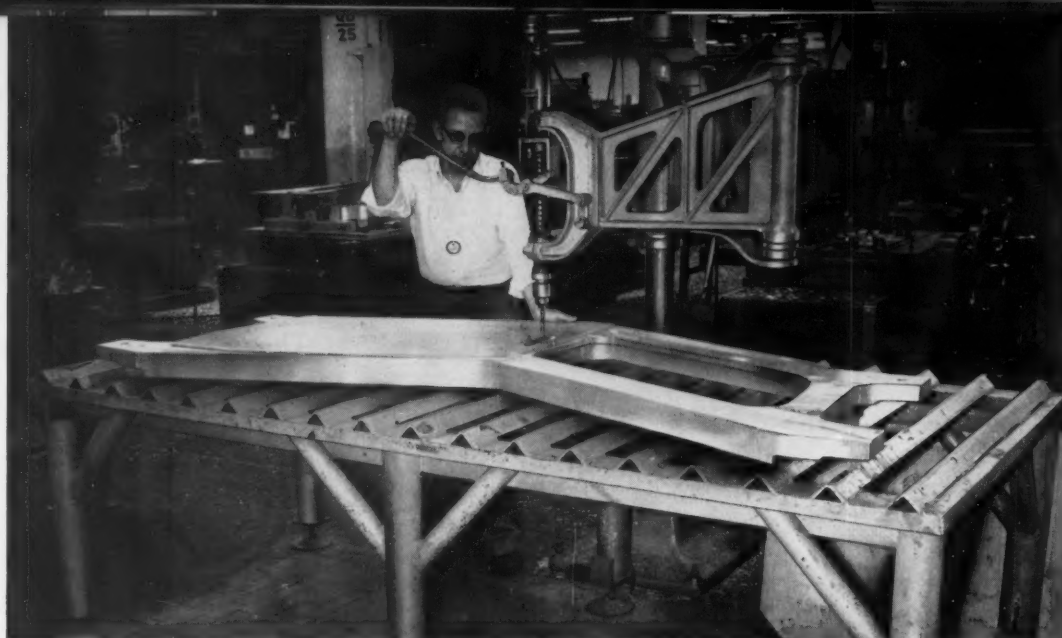
When in position for drilling, pins are pushed through the bushing plate and engage upright

pillars that are bolted to the work-table. One of these pillars can be seen at the lower left-hand corner of the table. Bushings are provided for drilling a total of seventy-six holes.

The frame is then placed on the table of a manually operated, radial type drill press having a hinged arm. Holes for attaching the webs are drilled in this set-up. A sheet-metal drill template is placed over one-half of the work-piece, Fig. 7, and the web-attachment holes in that section are drilled. Following this, the template is reversed and located on the other half of the part. All remaining web-attachment holes are then drilled

*Fig. 6. Holes employed to bolt two frames together are drilled under size. The frame is clamped to the fixture table and the bushing plate is rolled into place.*





*Fig. 7. After being finish machined, holes are drilled through the frame for attaching the web. The template shown being used can be reversed for drilling the other half of the part.*

with the "lazy-arm" drill press, bringing the total number of holes drilled in this operation to 286.

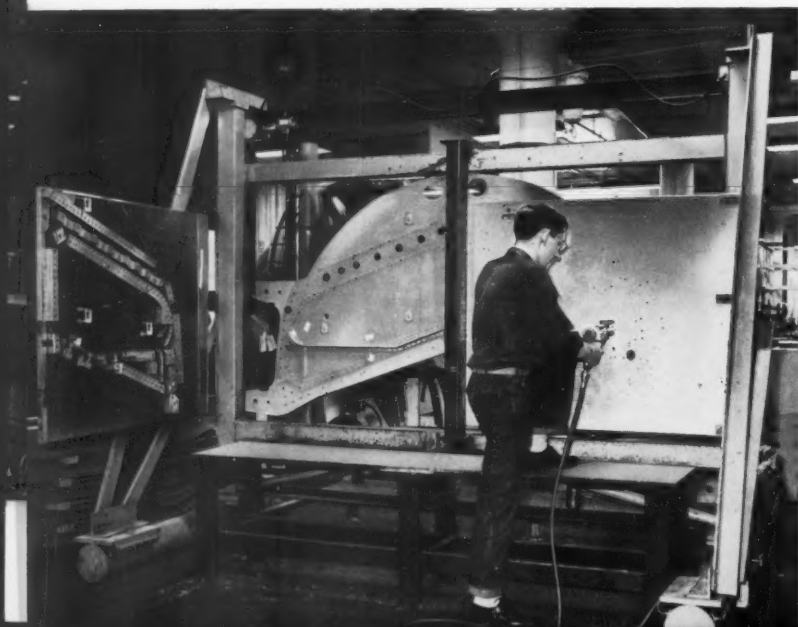
After being anodized and given a prime coat of zinc chromate, a web sub-assembly is fastened to the frame. This is performed in a vertical drill and assembly fixture as illustrated in Fig. 8. Two heavy steel plates are hinged to the fixture frame and can be swung closed on the work.

The inside faces of these plates contain loftings of the area being worked on. Guide holes are provided through the plate for locating additional holes that must be drilled, and backing plates are screwed directly to the loftings to insure accurate location. After drilling the required holes with a portable drill, rivets are inserted from the reverse

side of the frame. The assembly is then removed from the fixture and the rivets are driven on a Chicago Pneumatic riveting machine.

Two of these frame sub-assemblies are placed back to back in a holding fixture on the base of a Webo radial drill press, Fig. 9. The under-size holes for bolting the frames together are first line-drilled and then reamed to size. A surface finish of 63 micro-inches r.m.s. is maintained on the inside of all these bolt holes to guard against the build-up of any local stresses during operation of the aircraft. The bolts are then installed and tightened to a predetermined torque value.

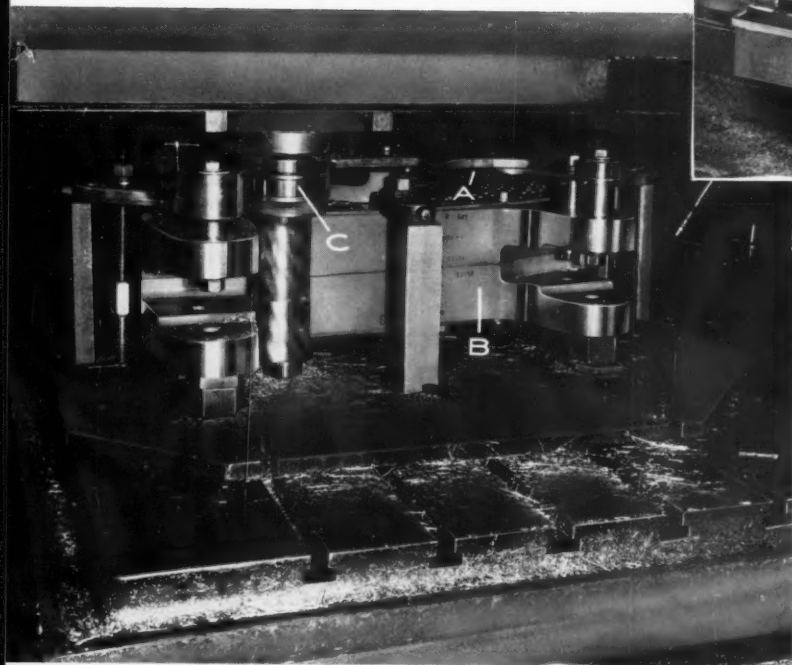
The mounting ears are contoured on a Morey profiling and milling machine, Fig. 10. A flat tem-



*Fig. 8. Webs and frames are drilled in this drill and assembly fixture. Loftings of the component are attached to two swinging doors of the fixture to insure accurate alignment of the parts.*



*Fig. 9. (Right) Drilling and reaming holes for bolting two frame sub-assemblies back to back. Hole surfaces are held to a finish of 63 micro-inches r.m.s.*



*Fig. 10. (Left) After the center-section spar sub-assembly is bolted together, the contours of the mounting ears are profile-milled to size. The profiling template is positioned directly above the work-piece.*

*Fig. 11. (Right) Machining the inner surfaces of the mounting ears to provide adequate spacing between them. The end of the main wing spar fits in this space between the ears.*





*Fig. 12. Sixteen wing-spar fitting holes are line-bored in this set-up on the base of a radial drill press. The holes are later buffed and checked for surface defects.*

plate A is supported above the "garden gate" fitting B. Two helical plain milling cutters of high-speed steel are ganged on the machine spindle. Immediately above the cutters, and concentric with them, is an anti-friction bearing C which serves in the capacity of a follower. Being a hand-profiling operation, bearing C must be held in contact with the edge of the template by the operator as the cutters are fed around the ears.

Inner ear surfaces are machined to provide proper spacing for the ends of the main wing spars. This operation is performed on a Kollmann planer-miller, Fig. 11. A 14-inch diameter slotting cutter having high-speed steel tooth inserts is

rotated at a speed of 60 R.P.M. and is fed into the work at a rate of 2 inches per minute.

Newly machined areas are checked for surface discontinuities by means of the Zyglo fluorescent-penetrant inspection process. The center-section spar assembly is then placed in a boring fixture and held in place by four toggle clamps, two at each end. The fixture is supported on the base of a Webo radial drill press as shown in Fig. 12. A total of sixteen wing-spar fitting holes are bored in this set-up.

Finished hole diameters of 1.7500 inches plus or minus 0.0001 inch are bored with a single-point tool having a carbide cutting tip. The sur-



*Fig. 13. Steel bushings are refrigerated to a temperature of minus 50 degrees F., causing them to shrink 0.001 inch in diameter. They are then placed on a mandrel and quickly plunged home.*

face of these holes is also required to have a finish of 63 micro-inches r.m.s. All of the bored holes are buffed, after which they too receive a Zyglu fluorescent-penetrant inspection.

Steel bushings are shrunk-fit into each one of the sixteen wing-spar fitting holes. A two-piece mandrel is used to facilitate rapid insertion of the chilled bushing into the fitting holes. One section of the mandrel is passed through the holes from behind and locked in place. This leaves a guide rod protruding through the hole, as can be seen in Fig. 13.

Prior to assembly, the bushings are packed in dry ice and acetone and allowed to steep for one-half hour. At the end of this time they have been brought to a temperature of minus 50 degrees F. and have shrunk 0.001 inch on the diameter. The mandrel is then slipped into one of the bushings and is quickly run over the guide rod projecting from the fitting hole—the chilled bushing being instantly driven home. Once the bushing has been removed from the dry ice, it must be positioned in the hole rapidly since it begins to expand immediately upon contacting the warmer room air.

## Precision Casting in Glass-Powder Molds

**A** LOW-COST precision metal casting technique utilizing one-piece glass-powder molds was recently announced by Corning Glass Works, Corning, N. Y. The method, known as the Glascast disposable pattern process, follows the lost wax investment casting technique in certain aspects. However, it eliminates entirely the need for investment material and knock-out equipment.

The lightweight molds are made by dipping a wax pattern into a Glascast slurry, coating it with coarser Glascast grains, and, after drying the assembly, dipping and coating it several times to build up the mold shell. The assembly is then fired (with the wax pattern being removed at the same time) and the mold, 1/8 to 1/4 inch thick, is ready for casting without further treatment.

The process was developed for casting close-tolerance precision parts of high-temperature alloys. The one-piece molds, capable of withstanding extremely high heat and sudden temperature changes, yield blemish-free castings with surface finishes of 20 to 40 micro-inches.

Tight dimensional control of fine definition castings is assured by the extremely low thermal expansion of the mold material, a 96 per cent silica glass powder. Low dimensional change and absence of firing shrinkage in the molds enable accurate calculation of metal expansion. The molds can withstand metal pouring temperatures of 3300 degrees F. Metal contraction after casting causes the non-contracting Glascast mold to crack off, freeing the casting from adhering ceramic.

*Glass-powder mold for precision metal casting is produced by dipping wax pattern (top left) in Glascast slurry, coating with Glascast grains, drying, and repeating cycle until mold shell (right) is built up.*



# TRACER-CONTROLLED MACHINES SPEED WORK AT CONVAIR

By A. P. HIGGINS

Plant 2 Works Manager  
Convair, a Division of General Dynamics Corporation  
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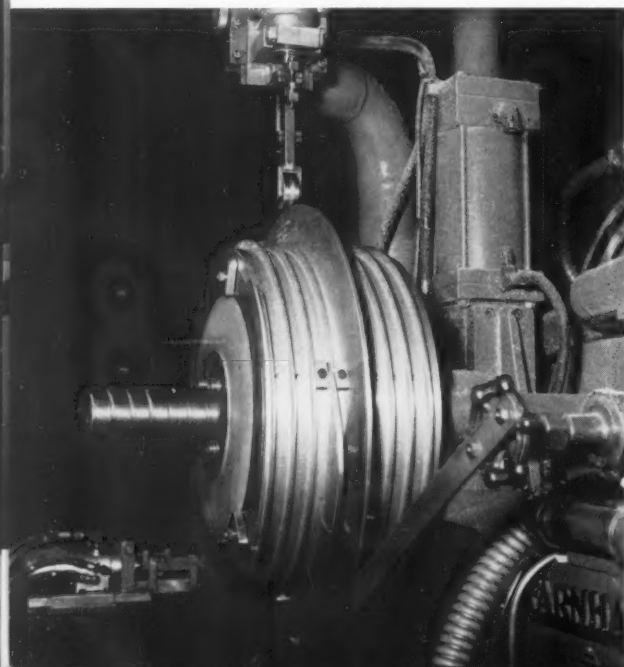
**A**CCURATE repetitive production of unsymmetrical work-pieces is usually time consuming and requires the services of highly skilled workmen unless the machines employed are equipped for automatic control of the operations involved. Recognizing this principle, the Convair management has installed a number of machine tools in the machining departments which are provided with tracer devices for guiding the cutters with respect to the work. Machining time has been reduced to a minimum and semiskilled workmen run the equipment.

One of the outstanding tracer type machines was especially designed for producing spiral cams for use on Farnham spar mills. Until several years ago, all spar mills of this type were provided with flat narrow templates or cams that were attached to the sides of the machine bed (adjacent to the rails) to control the rise and fall and transverse motions of the cutters as they were carried along the work by the gantry. The cams had to be as long as the spars and were coordinated with them on the machine. For large aircraft, spars that are 50 feet long and longer are not uncommon. The spiral cams produced by this new machine are only about 2 feet in diameter.

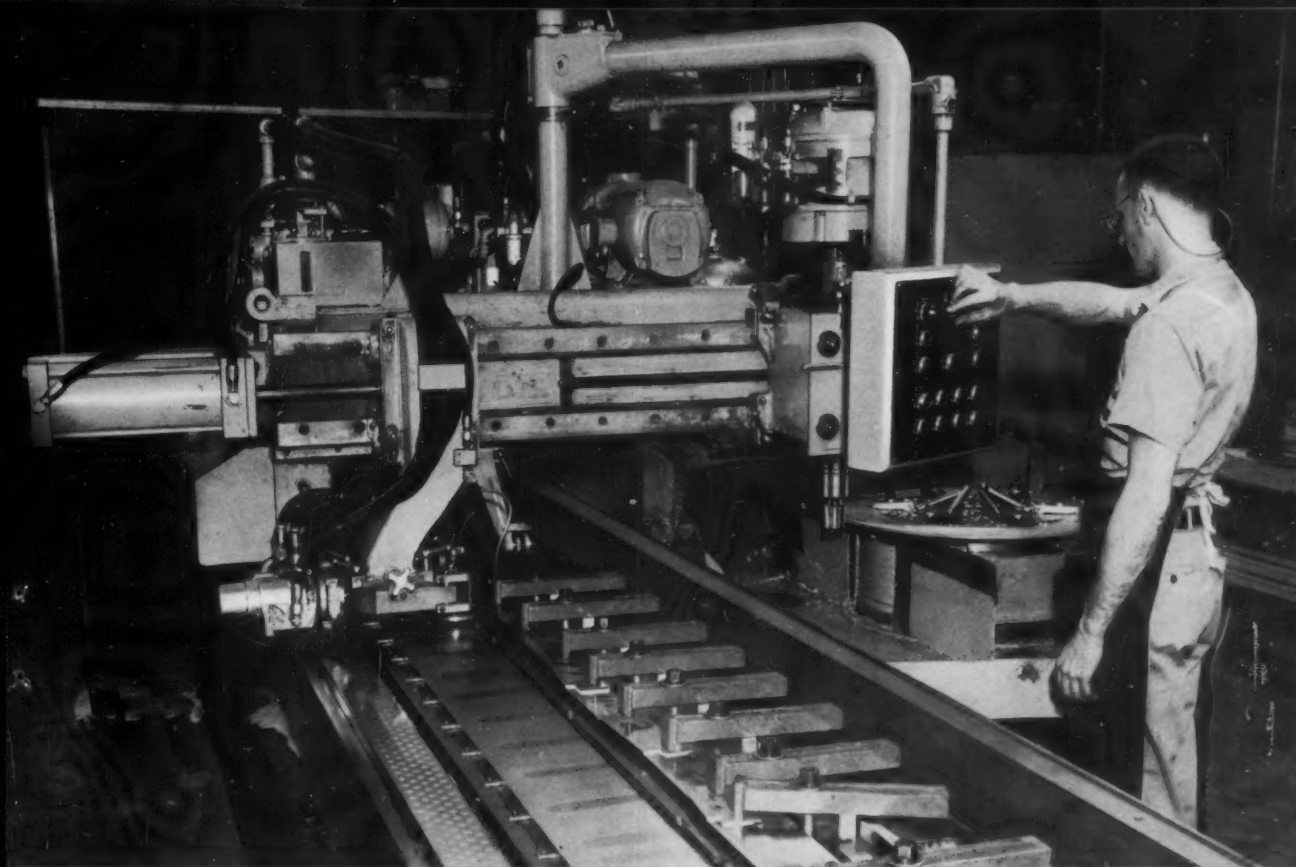
The spiral cams are mounted on the spar mills as shown in Fig. 1 and occupy a comparatively small space. The individual cams are stored with their drums, and, therefore, a great amount of storage space is saved. Each cam is made in sections, the sections being fitted halfway around the drum. When assembled, the cam sections form a continuous spiral. The cams are made in a 1 to 2 linear ratio with respect to the spars—in other words, for 1 inch of tracer movement along the cam surface, the cutter moves 2 inches along the spar being milled.

The machine for milling the cams was Convair specified—designed and built by the Farnham Mfg. Division, Wiesner-Rapp Co., Inc. A general

*Fig. 1. Spiral cam of the type used to control the movement of cutting tools on Farnham spar mills in the Convair plant.*







view of the machine is shown in the heading illustration. The spiral cam making machine consists of a long bed, upon which is mounted a gantry having a True-Trace hydraulic unit at the left for actuating a cutter-head mounted at the right. The cam segments are clamped on a rotary table (also mounted on the gantry) at the right-hand side of the machine, which revolves at a peripheral speed of half that of the linear feed of the gantry. This then is the method for translating rectilinear data to curvilinear data. A close-up view of the tracer unit is presented in Fig. 2, and of the rotary table in Fig. 3.

Flat templates about 1 foot wide are mounted along the bed, as indicated at A, Fig. 2, to construct a duplicate of the edge required on the spar for which a cam is to be produced. The total length of assembled templates is usually about 12 feet. However, the machine table is 26 feet long and templates can be assembled on the table for spars of that length. The template sections are accurately set up on the machine by means of gages on solid bars that are mounted on the front way C, Fig. 2, of the bed.

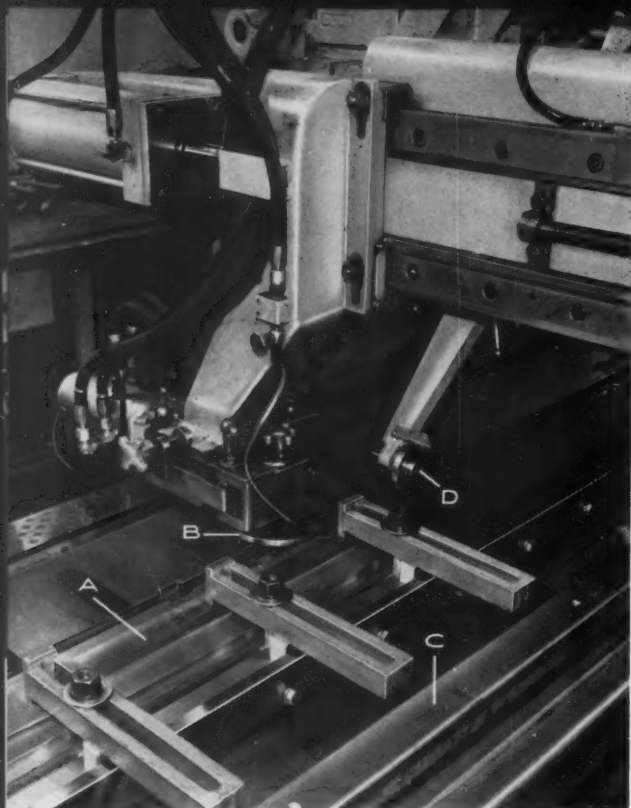
Roller B, Fig. 2, of the tracer unit travels along the edge of the templates and as the roller is moved sideways in accordance with the rise and fall of the assembled templates, the cutter moves similarly in relation to the circular cam segments on the rotary table. At points where a

long straight section is desired on a spar that would necessitate templates having edges placed parallel to the sides of the table, it is not necessary to provide templates. In such cases, the threaded end of the micrometer D, Fig. 2, is contacted against a flat surface on the tracer housing, and this prevents inward movement of the tracer unit. The cutter then produces a concentric circular surface as the work revolves past it. The templates are fastened to the machine table by handy clamps that are quickly secured and loosened.

The method of mounting the cam segments on the table will be apparent from Fig. 3. Three quickly actuated clamps hold each segment securely. While one segment is being milled, the opposite segment is loaded on the table so that the cut can be continuous, even though four or five segments are required for a complete cam.

A helical type milling cutter with two carbide blades is employed, the cam segments being made of aluminum alloy. The cutter is 2 inches in diameter and runs at 3600 R.P.M., although speeds up to 7200 R.P.M. are obtainable. The work on the table revolves at a speed of 15 to 18 inches per minute. Mist coolant is supplied to the cutter and work by Norgren equipment.

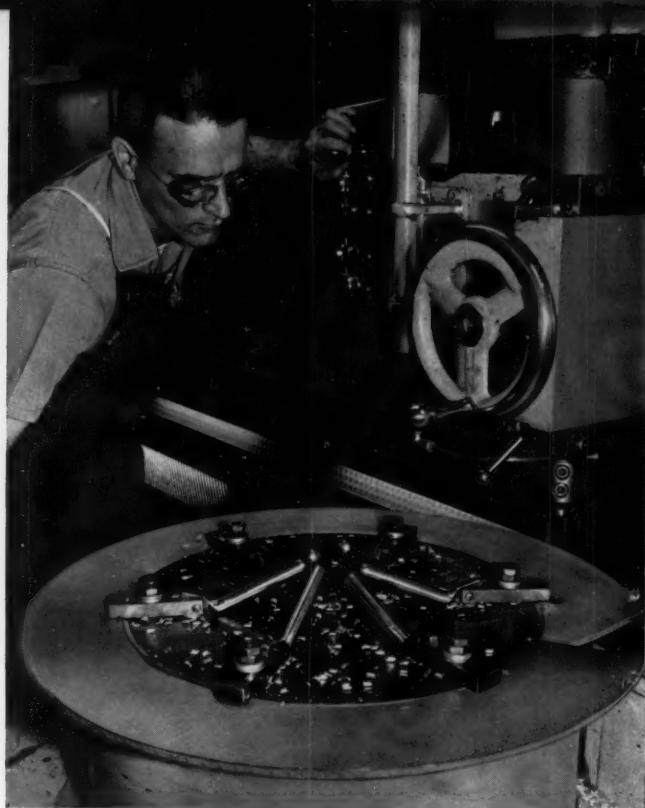
Straight cams, of the type formerly used exclusively on Farnham spar mills, can also be produced on this machine. In such operations, template sections are mounted on the table in the



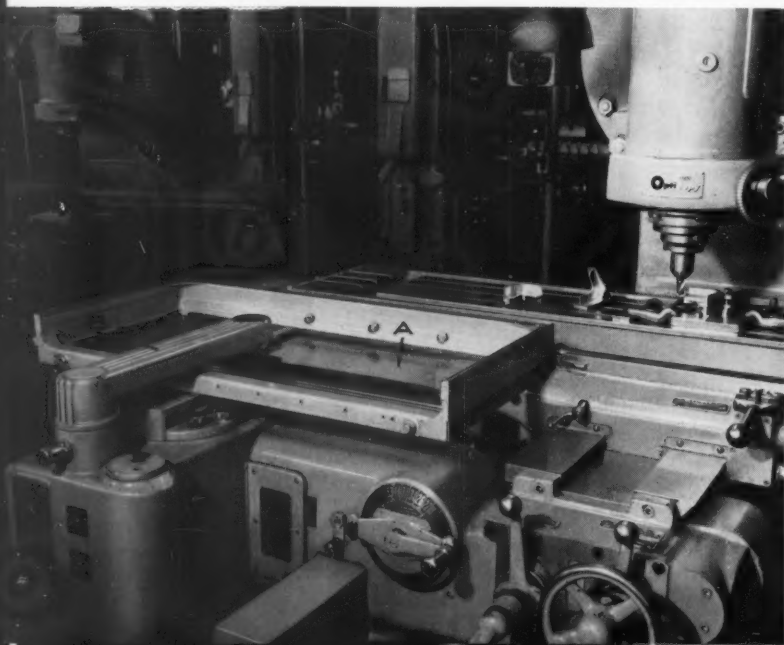
same manner as in milling spiral cams. However, the long cam to be produced is mounted along flat surface C, Fig. 2, at the front of the machine bed, and the cutter is positioned along the back edge of the part.

With the Farnham machine, complicated spiral cams can be produced in eight hours, whereas weeks were formerly required in making the cams principally by hand. At that, the handmade cams were seldom satisfactory.

Another unusual machine is the Opticopy verti-



cal milling machine illustrated in Fig. 4, which is manufactured by Kearney & Trecker Machine Tool Co. This machine is equipped with a tracer device having an electric eye that "observes" a flat template or pattern mounted beneath the glass which forms the top of table A. This table is attached to the front of the regular machine table. The electric eye is carried by arm B. As the template is moved under the electric eye when the milling machine table is fed longitudinally, the eye actuates electrical equipment,



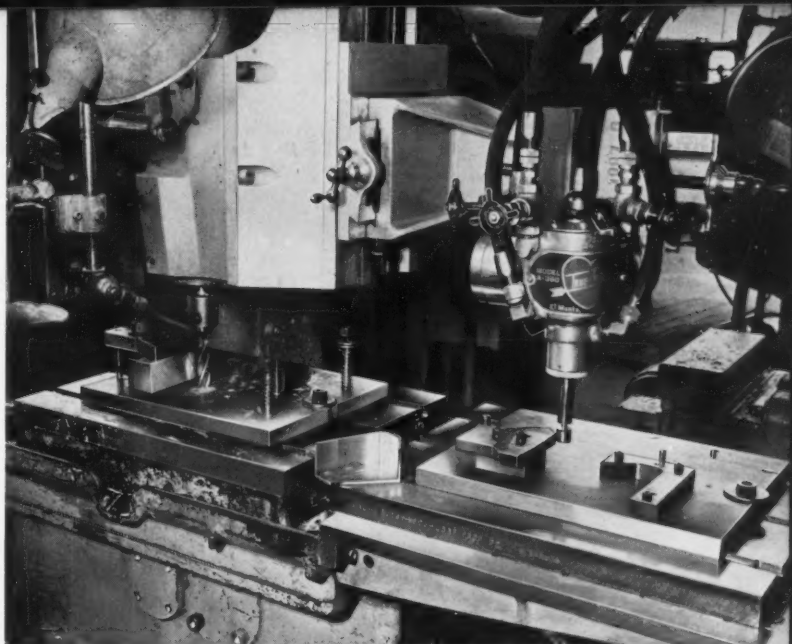
*Fig. 2 (Above left) View of the tracing unit on the machine shown in the heading illustration, which controls the operation of the cutter in producing spiral cams of the type seen in Fig. 1.*

*Fig. 3. (Above right) Segments of the spiral cam are milled while mounted on a rotary table on right-hand side of cam miller shown in heading illustration.*

*Fig. 4. (Left) Opticopy milling machine on which the movements of the work-table are electronically controlled by the combined use of a template, electric eye, parallel ray light source, and rotating aperture.*

*Fig. 5. (Right) Vertical milling machine equipped with a hydraulic tracing unit for accurately controlling movements of the cutter in profiling operations on intricate parts.*

*Fig. 6. (Below) Turret lathe operation in which a hydraulic tracer unit governs the in and out movements of the cutting tool in producing a contoured work-piece. "Throw-away" carbide cutters are used.*



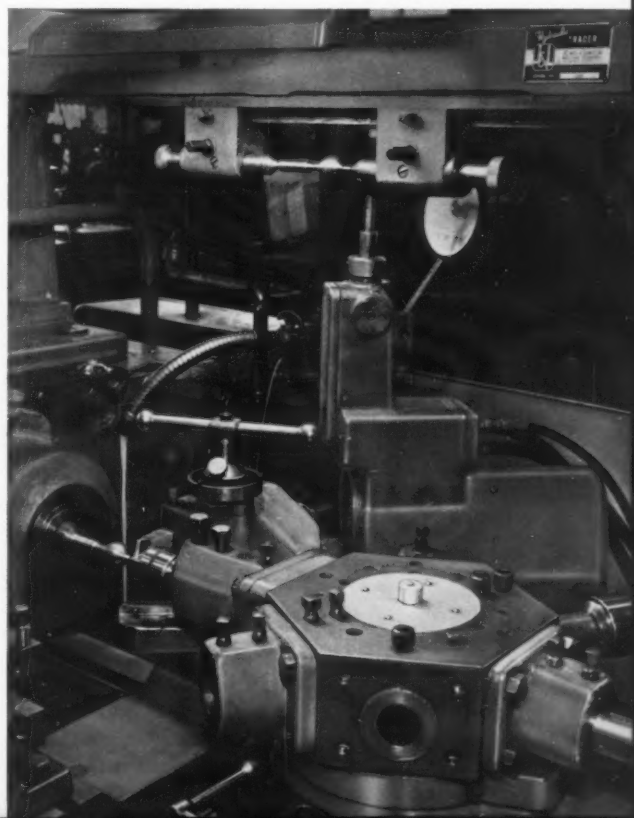
causing the table to move in and out in accordance with the outline of the pattern. Simple drawings showing the outline of the work can be used as a pattern. Plate-glass photographic negatives, to which an opaque has been applied to emphasize the outline of the work, are used for the same purpose. Templates may be as thick as 1 inch.

When the photograph, Fig. 4, was taken, the work consisted of a drive-support fitting of 7075-T6 aluminum alloy on which stock is milled away on the inside of the part in two settings of the work so as to leave a narrow rib in the approximate center. The tolerance on the rib thickness is plus or minus 0.010 inch. However, parts are customarily milled with this equipment accurate within 0.003 inch.

Routing operations of various types are performed on the Morey vertical milling machine shown in Fig. 5, which is also equipped with a True-Trace hydraulic tracing head. In the particular operation shown, a solid aluminum 7075 block 1 1/2 inches thick is milled to sections as thin as 1/16 inch. Two templates can be seen on the tracer table at the right. The stylus of the tracing head is moved around the one template, as shown, for milling the exterior surface of the part. It is then moved along the inside of the template at the right to mill the inside surface of the work-piece. With such a set-up there is no danger of accidentally gouging out more stock from a work-piece than is desired.

A considerable variety of work is handled by the Jones & Lamson turret lathe illustrated in Fig. 6, which is set up for turning eye-bolts made of Hy-Tuf steel. When being machined, the material has a tensile strength of between 160,000 and 170,000 pounds per square inch and is later

heat-treated to obtain a tensile strength of 240,000 pounds per square inch. The operation is particularly severe on the cutter, and for this reason "throw-away" carbide cutters are employed. This eliminates the necessity of frequent cutter sharpening and also resettings of the tool-holder. A mirror enables the operator to clearly observe the movement of the stylus along the back side of the template. The latter can be seen supported on the centers of slides attached to the under side of the overhead tracer-unit arm.





# MULTI-PURPOSE MACHINES

## Meet Varied Production Needs

By J. L. McGINNIS  
Assistant Works Manager  
Jack & Heintz, Inc.  
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**Orders for aircraft components may vary from a few to many thousands. Outstanding examples of versatile equipment and ingenious tooling employed to permit economical production of such varied requirements are here described.**

**A**IRCRAFT components manufactured by Jack & Heintz, Inc., Cleveland, Ohio, include electrical, hydraulic, or mechanical devices designed to generate, control, or apply power. The company produces approximately 50,000 major aircraft units annually, involving as many as 100 models of starters, inverters, generators, motors, actuators, and similar products.

Constant improvement in product design and

fluctuations in military requirements result in orders ranging from a few to many thousands of a particular component. This production headache is aggravated by the complexity of the units. For example, a representative generating unit, weighing only 53 pounds and occupying less than 1 cubic foot of space, consists of eight major sub-assemblies and more than 2200 component parts. The manufacture of this generator requires 1660 operations involving 75 machine tools as well as forging, heat-treating, plating, painting, and inspection equipment. In addition, more than 1200 special-purpose jigs, tools, dies, and test fixtures are required.

Economical output of short-run as well as mass-production requirements for so many different parts demands creative thinking on the part of tool and process engineers, and the use of multi-purpose machines whenever possible. Outstanding examples of such versatile equipment and ingenious tooling are described in this article.

Where the quantity of armature and field laminations, starter clutch plates, or similar parts for a particular order does not justify the cost of an expensive progressive die, such parts are produced economically with a segmental die on the V & O rotary indexing, 5-ton notching press, see Fig. 1. The number of teeth notched or holes pierced per stroke varies with the size and design of the part. For example, in producing a starter clutch



**Fig. 1. Small-lot production of starter clutch plates is economically performed on this indexing notching press by the use of a segmental die.**





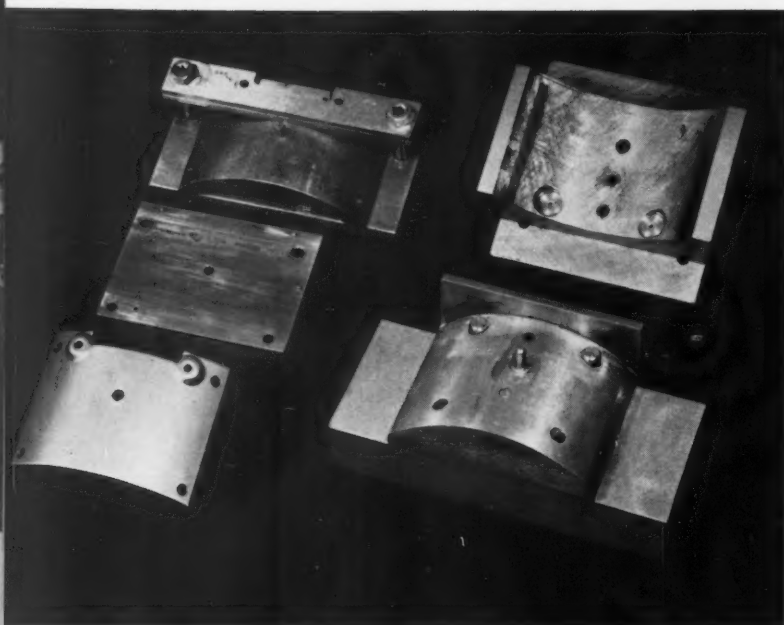
plate from a phosphor-bronze blank, 5 inches in diameter by 0.016 inch thick, five holes are pierced and four teeth are notched per press stroke. Since this plate contains 100 holes (0.090 inch in diameter) and 80 teeth (of 16/21 diametral pitch), twenty press strokes are required to complete the part. Press speed is variable from 250 to 750 strokes per minute.

The blank is located by a pilot-pin on the work-holding fixture, and driven by a key entering a notch in the blank bore. A roller gear, worm type driving arrangement transmits intermittent motion to the fixture. Change-gears regulate the number of indexes. Segmental dies of the type shown can be made for less than 10 per cent of the cost of progressive dies.

Typical of the many inexpensive dies made at Jack & Heintz for low-production requirements is the one shown in Fig. 2. This temporary die set was designed to form and draw radio noise filter bases for generators from 0.093-inch thick, AISI

1010 steel blanks. Initial requirements were for only eleven bases. In two succeeding months, 120 more bases were produced, but future requirements were uncertain. A cost estimate for making a conventional hardened and ground die for stamping this part amounted to \$1800. However, the low-cost temporary die set illustrated was made for only \$300.

All parts of the temporary die were made from AISI 1018 cold-rolled steel, left unhardened and unground. The punch and die were cut to the required shape on a DoALL band-sawing machine. The die is secured to a universal die-holder, and the punch is held above a support plate by three standard stripper bolts. Two standard 1/2-inch diameter dowels, projecting from the top surface of the support plate, pass through holes drilled in the punch and enter holes sunk in the die to draw two ears to a height of 3/8 inch on each blank. The support plate also serves as a pressure pad during drawing. A standard rubber stripper is



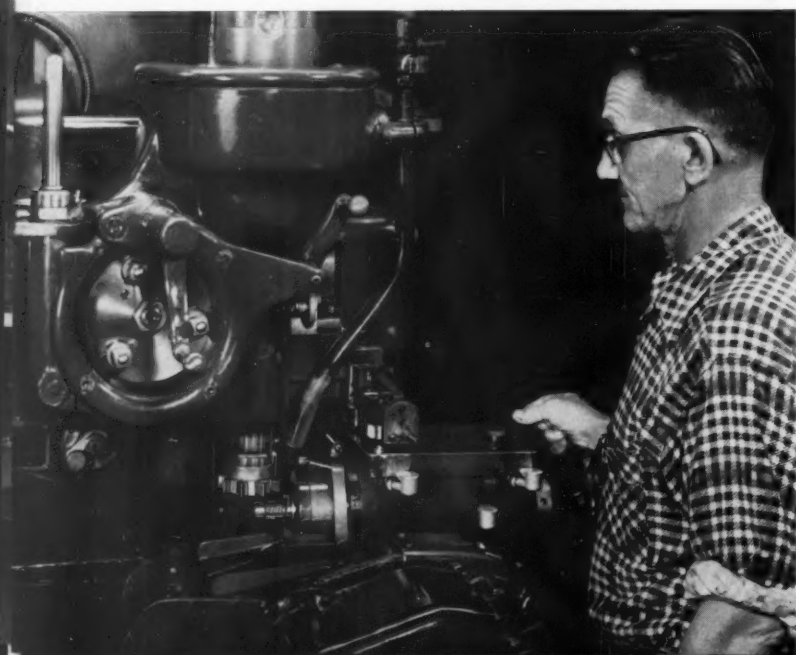
*Fig. 2. Low-cost temporary die set for forming and drawing radio noise filter bases for generators from 0.093-inch thick steel blanks.*

mounted on the under side of the support plate by a stud, washers, and a nut.

Costly, time-consuming operations were previously required in cutting the helicoidal engaging surfaces on the faces of aircraft engine starter jaws. Production of these so-called "spiral-jaw" clutches was further complicated by the number of different designs required to suit various types of starters. The number of "teeth" ranges from three to twelve, and some jaws are made in both right- and left-hand styles for clockwise or counter-clockwise rotation. Because of the high shock loads to which the jaws are subjected during operation, they are made from AISI 4620 steel

forgings. Previous methods of manufacture required several machines and operators to rough- and finish-face the forgings, and then rough- and finish-generate the rise of the jaw teeth on milling machines.

Now, the contoured engaging surfaces on the starter jaw teeth are generated in one automatic cycle on a standard Fellows gear shaper, Fig. 3, with one operator attending four machines. The shaper is equipped with a standard face gear attachment, riser blocks, and an electrical timer which controls the number of teeth to be cut on each part. By means of the face gear attachment, rotation of the vertical work-spindle on the stand-



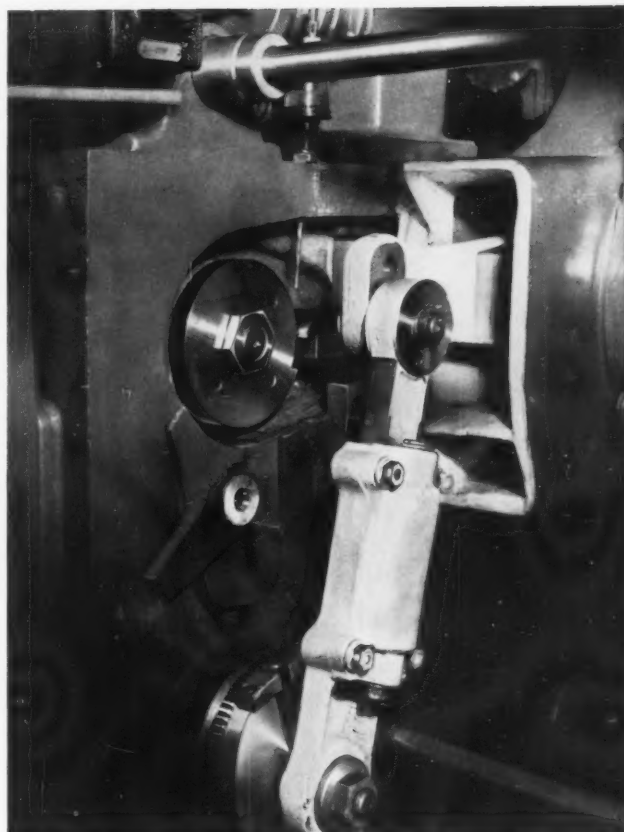
*Fig. 3. Shaper equipped with a standard face gear attachment has been modified to generate helicoidal surfaces on engine starter jaws.*

ard machine is translated through change-gears and a worm and worm-wheel to rotate the work slowly about its horizontal axis. The cutter-spindle is locked to prevent rotation, but is reciprocated by a crank mechanism.

A cam mounted at the upper left on the machine, Fig. 4, makes one complete revolution for each tooth required on the starter jaw and moves the saddle and cutter-spindle toward the work-piece at a predetermined rate. For the three-tooth starter jaw shown, the cutter-spindle is reciprocated at the rate of 550 strokes per minute and the work rotated to give a feed of 0.002 inch per stroke. When the interruption in the cam periphery passes the follower-block, the saddle and cutter-spindle return to their starting positions. Approximately 1/16 inch of stock is removed from each forged tooth surface, and the three teeth on this particular starter jaw are completed in a six-minute automatic cycle. The timer automatically stops the machine at the completion of the cycle.

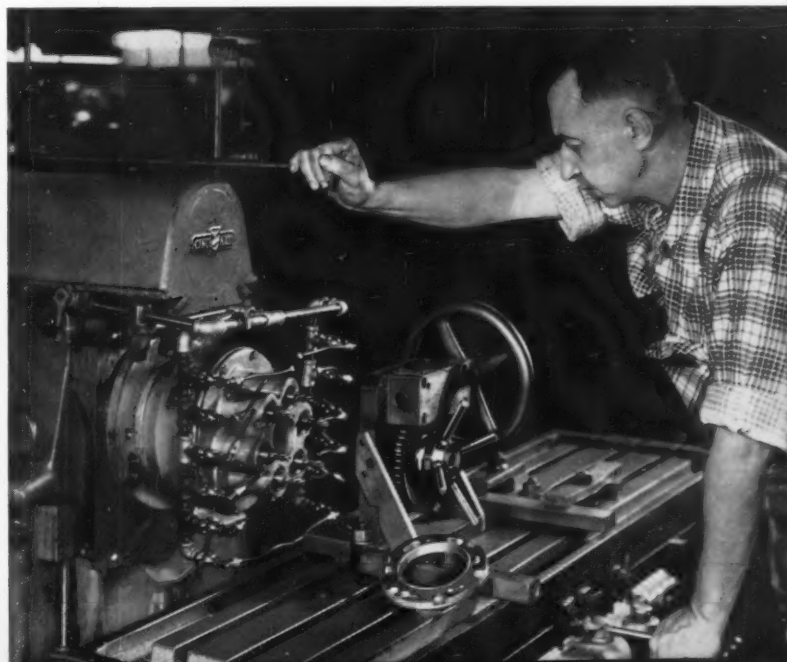
Machining is done with a single-point cutting tool, but nine tools are equally spaced around the periphery of the cutter. When one tool becomes dull, after machining four or five starter jaws, the operator indexes the cutter 40 degrees to present a sharp cutting edge to the work. Each work-holding fixture is designed to accommodate several different starter jaws. However, a cam and cutter are required for each size jaw. Savings resulting from this improved method paid for the modified gear shaper in less than a year.

Holes previously drilled in one end of generator housing plates on Natco multiple-spindle machines are elongated into slots by means of the unique set-up illustrated in Fig. 5. The slots are



*Fig. 4. Cam and follower (mounted at upper left on machine seen in Fig. 3) move the saddle and cutter-spindle toward the work-piece at a predetermined rate.*

*Fig. 5. Slots for quickly attaching generator to buttons on airplane are produced with a multiple-spindle cutter-head and fixture.*



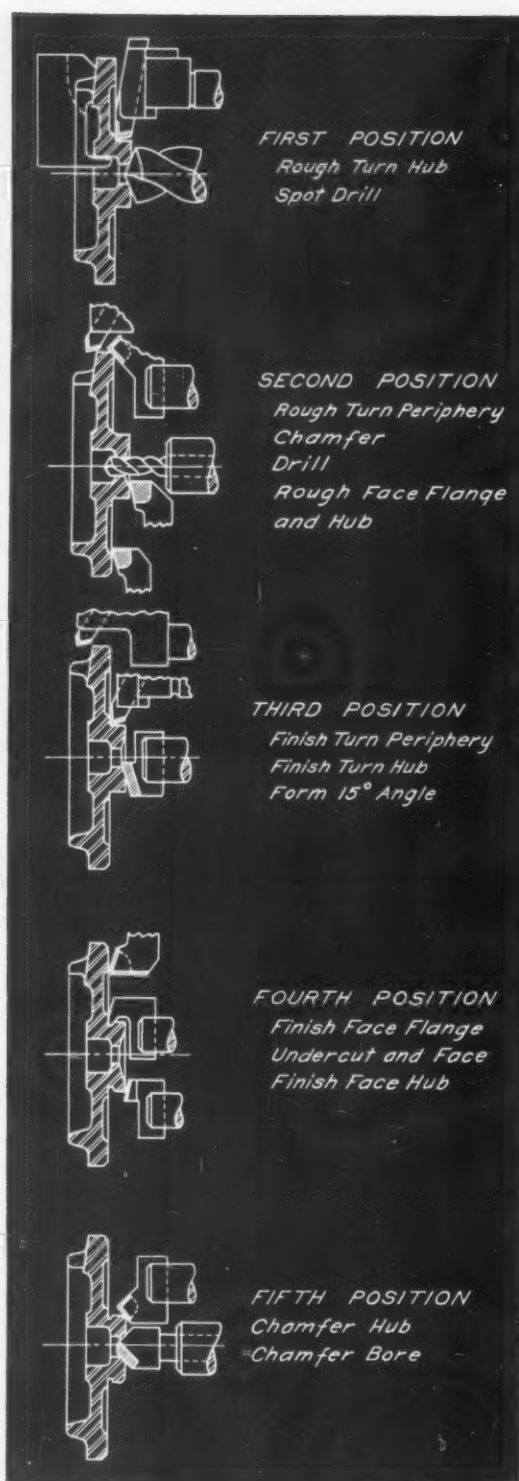


Fig. 6. Tooling employed on single-spindle, automatic chucking machine for producing cast-iron pulley end-bells in a four and one-half minute cycle.

used for quickly attaching the generator to buttons permanently secured to the airplane engine mount. In this slotting set-up, a multiple-spindle cutter-head is mounted on the Cincinnati horizontal milling machine, with each cutter-spindle rotated at 680 R.P.M. by gears from the main spindle of the machine.

The generator housing plate is placed in a special fixture mounted on the milling machine table, locating from one of the holes previously drilled in the plate. When the work-piece has been clamped, the machine table is fed transversely so that the end-mills enter the holes previously drilled. Then, the generator housing plate is rotated by means of a handwheel provided on the fixture. Various generator plates and housings require from four to twelve quick-mounting slots, but they can all be milled with the same cutter-head simply by using the necessary number of end-mills. Also, after completing the slotting operations, one end of each slot is back spot-faced by changing the tools in the same head. A production of fourteen generator housings per hour can be obtained from a single machine.

Medium-run lots of numerous aircraft component parts are economically produced on Warner & Swasey No. 1 AC single-spindle, automatic chucking machines such as the one seen in the heading illustration. On such machines, ease and speed of set-up are combined with fast automatic operation. A five-sided turret and both front and rear cross-slides permit a wide variety of tooling arrangements to meet diverse production requirements. Permanent cams for the turret and cross-slides make changes unnecessary. A pentagonal control drum on each machine is equipped with adjustable trips for the selection of feeds, spindle speeds, and length of cutting stroke. Also, the selector drum can be set up for skip indexing to shorten the cycle time on jobs not requiring the use of all turret tooling stations. Accessibility to the set-up controls and tools permits complete change-over of a machine in six hours or less.

The tooling employed on one single-spindle, automatic chucking machine for producing cast-iron pulley end-bells is illustrated in Fig. 6. After chucking the casting at the first position (gripping the part on its 1 5/8-inch diameter bore by means of three jaws), the automatic-cycle button is depressed. With the work rotating at 340 R.P.M. (240 feet per minute), a multiple tool-head on one side of the pentagonal turret is advanced at the rate of 0.005 inch per revolution. The same feed rate is used for all operations in producing this part. This head carries a single-point tool and twist drill for rough-turning the hub and spot-drilling the bore.

A second multiple tool-head on an adjoining turret face is then automatically indexed into the



**Fig. 7. Universal inert-gas arc-welding machine provided with four tungsten electrode holders to join several stator lamination stacks simultaneously.**



second cutting position. The work speed is automatically reduced to 138 R.P.M., providing a cutting speed of 300 feet per minute on the bell periphery. A single-point tool, a chamfering tool, and a twist drill are mounted on this head. Two single-point tools on the front cross-slide are fed into the work simultaneously to rough-face the flange and hub. Both cross-slides always feed at the same rate as the turret. Either front or rear cross-slide can be operated with any selected turret face or while the turret is dwelling.

Work speed is increased to 248 R.P.M. for finish-turning the periphery and hub of the casting at the third position. Also, a 15-degree taper is formed at one end of the bore. The flange and hub are finish-faced at the fourth position, with the flange facing tool mounted on the rear cross-slide. An under-cut is also formed and faced at this position. Two tools are mounted on another turret multiple head at the fifth and final position for chamfering the hub and bore. Machine cycle time for this part is about four and one-half minutes, and one man operates two machines.

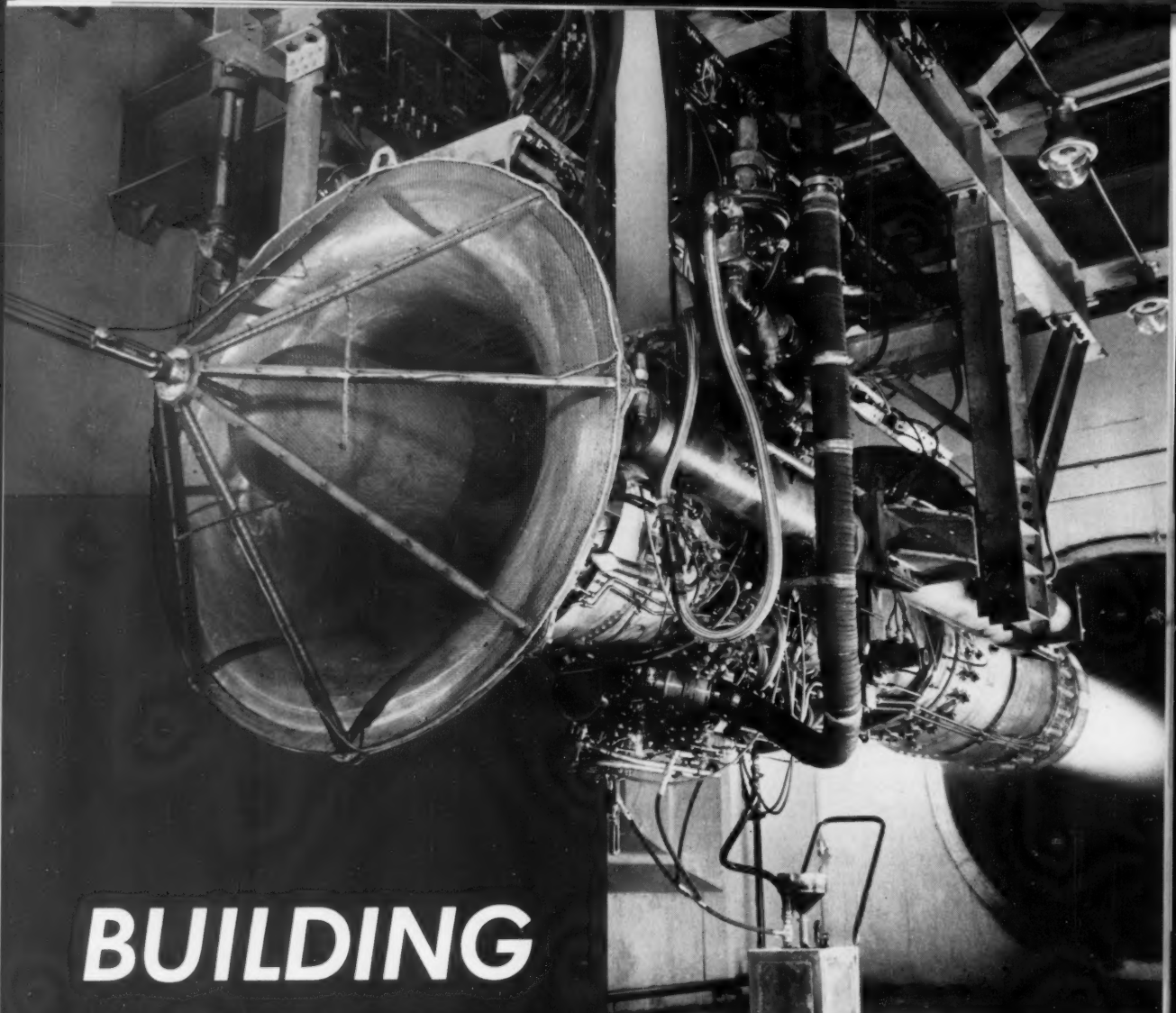
Considerable savings have been obtained in stacking stator laminations by employing a universal inert-gas arc-welding machine, Fig. 7, equipped with from one to eight Linde Heliarc heads. The number of heads used depends on the design of the generator, alternator, inverter, or other aircraft component for which the stator laminations are being assembled. Previously, the lamination stacks were assembled by pressing

into spun cans, riveting, or bonding. All of these former methods were much more costly and time consuming.

Now, stator laminations are placed on a steel arbor and pressed together to obtain the specified stack height. The arbor has a copper base and threaded top, over which a C-washer and nut are placed. From four to eight stator assemblies are placed on the vertical arbor and welded simultaneously, the number depending on the stack heights. Copper separators are placed between adjoining stacks. Then, the assembly is mounted in the universal welding machine, a cover is lowered for operator protection, and the automatic cycle is initiated.

In the set-up shown, six stator assemblies—each containing 156 laminations, 0.014 inch thick—are welded at a time, making four equally spaced welds along each stack. Non-consuming tungsten electrode arcs are used. Since no flux or filler metal is employed, inclusions in the welds are minimized and there is no spatter. Heat-affected zones are narrow, and the beads produced are very smooth and within 0.030 inch of the desired 1/16-inch penetration. Welding is performed at up to 300 amperes and 20 volts direct current, with argon as the inert shielding gas. Rate of traverse of the air-actuated electrode holders is adjustable, with an average speed of 20 inches per minute. The stroke of the holders is also adjustable up to a maximum of 18 inches.

*(Concluded on page 203)*



# **BUILDING POWER INTO JET ENGINES**

By **LAWRENCE M. LIMBACH**  
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Ryan Aeronautical Co.  
San Diego, Calif.

Photo, Aircraft Engine Division of Ford Motor Co.

Machine shop operations in turning out components for jet engines that propel many different types of fighter planes and which are now being planned for application to huge transports—operations in a plant that has earned a reputation for high-grade welding and machining of fabricated parts

**T**EN THOUSAND pounds of thrust is the rated capacity of the Pratt & Whitney Aircraft J-57 jet engine which has been widely adapted for military planes and which has now been selected also for driving 100-passenger transports. When a plane equipped with this type of engine flies at the speed of sound, the engine develops the equivalent of 20,000 H.P. If an afterburner is used for greater performance, 30,000 H.P. is developed—sufficient power to drive a 10,000-ton warship.

Engines of such power must be built of components made from materials of the highest quality and machined to close tolerances. The Ryan Aeronautical Co., San Diego, Calif., has been an important producer of major components for these engines, including such parts as compressor and turbine cases, flame-holder and combustion chamber weldments, afterburner ducts, and engine mounting cases.

More precision machining operations are necessary on J-57 engines than on any previous jet engines, and 75 per cent of Ryan's work in producing the components consists of machining. Even sheet-metal "skins," which, in combination with flanges, make up the various casing components, must be precisely formed and accurately machined because all main sections are butt-welded together in the final assembly of the engine parts.

Some of the most dramatic machining opera-

tions are performed on forged H-rings, such as seen in Fig. 1, which weigh 487 pounds in the form of rough forgings. After nine hours of machining—performed in ten operations—the rings weigh only 90 pounds, a total of 397 pounds of metal having been removed. Cuts as wide as 3/4 inch are taken to a depth of 0.008 inch on the high-temperature alloy at a speed of approximately 475 feet per minute. The H-ring and all other flanges used on the jet-engine cases are made of No. 410 stainless steel.

The manner of forming a skin for an engine case to two diameters with a tapered section, from a cylindrical weldment, is illustrated in Fig. 2. The skin is normalized after welding. The forming operation is performed on a hydraulic press equipped with a segmental punch. The segments expand outward horizontally after the punch has been lowered into the work to the proper position. The arrangement of the punches will be apparent from Fig. 3. The material from which the skin is fabricated is No. 310 stainless steel, 0.060 inch thick. When the case comes from the press, the diameters must be to size within 0.010 inch. The operation is performed cold on the thin sheets of material.

After the forming operation, the case is turned to length on a Bullard vertical turret lathe set up as illustrated in Fig. 4, the length of the part being held to size within 1/32 inch. The skin is then welded to a cylindrical section on the Taylor-Win-

*Fig. 1. H-rings awaiting finish machining in vertical turret lathes. These rings weigh 487 pounds as rough forgings and only 90 pounds when finished.*





**Fig. 2. (Left)** Thin skin for jet-engine case which is formed as shown from a cylindrical weldment by the use of an expanding punch.

**Fig. 3. (Right)** Illustration showing construction of segmental punch used in the operation seen in Fig. 2 to produce skins of two diameters from a cylindrical weldment.



**Fig. 4. (Left)** Trimming one end of a thin skin section on a vertical turret lathe prior to butt-welding the part to another cylindrical skin, as illustrated in Fig. 5.





*Fig. 5. Skins are welded together and flanges attached to the ends of the skin sections by seam welding, arranged on machine as here shown.*

field seam welder shown in Fig. 5. The same process is employed in welding the flanges to both ends of the part. After the welding operations illustrated, holes are pierced around the skin and stainless-steel bosses are welded in the holes. The flanges are then turned and faced on both ends with the work set up on Bullard vertical turret lathes. The location of the boss holes and the flange dimensions are held within plus or minus 0.005 inch.

When the H-rings seen in the foreground of Fig. 1 have been turned and faced on a Bullard

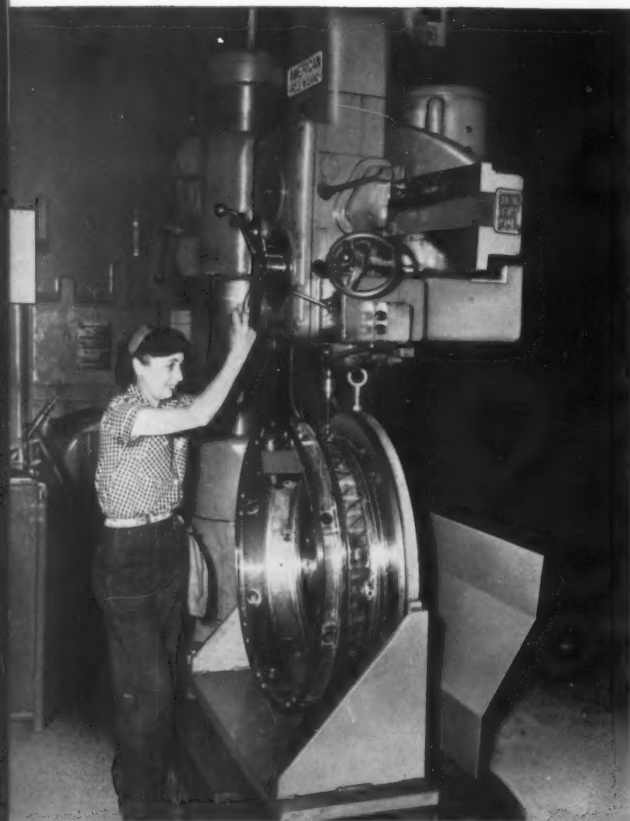
vertical turret lathe, stock is removed from the face of one flange in such a manner as to leave thick sections or bosses at eight points around the periphery of the part. This operation is performed by end-milling on the Kearney & Trecker milling machine shown in Fig. 6. The centers of the bosses must be located as specified within plus or minus 0.005 inch. The bosses are first scribed on the part and the operator is responsible for facing along the scribed lines. The operation is complicated somewhat by the fact that the inside of the flange rim is eccentric with re-

*Fig. 6. End-milling operation in which stock is removed from the face of a flange for lightening purposes, with bosses remaining to receive the engine mount supports.*





**Fig. 7. Radial drilling machine employed for drilling a total of 200 holes in the opposite flanges of a narrow jet-engine component which consists of an H-ring, skin, and flange.**



spect to the periphery so that the rim thickness varies around the part. The bosses provide a surface for attaching engine mount supports. In the various turning and facing cuts on the H-ring, care must be observed to avoid removing too much material at one time as that would cause distortion.

After the H-ring has been assembled to a short skin and a narrow flange is welded to the opposite end of the skin, the unit is delivered to the Carlton radial drilling machine illustrated in Fig. 7 for drilling and reaming holes in both flanges. A total of 120 holes are drilled and reamed in the face of the H-flange by the use of detachable drill-bushing holders, and eighty holes are drilled in the opposite flange. Hole-center distances are held within plus or minus 0.002 inch. An American radial drilling machine, employed to drill and ream eight holes of 5/8 inch diameter in bosses welded to the thin skin of this assembly, is illustrated in Fig. 8. The rotatable workholding fixture is designed for convenient indexing and accurate locking in the proper drilling and reaming locations.

**Fig. 8. Another radial drilling machine used for drilling eight important holes in stainless-steel bosses that have been welded to the thin skin of a jet-engine component.**

*Fig. 9. Heavy cuts are taken in this boring mill set-up through the use of "throw-away" carbide tool bits, although brazed tool bits were being used when photograph was taken.*



A turning, boring, and facing operation on a typical component is being performed on the King vertical boring machine shown in Fig. 9. Semifinishing cuts are taken within an accuracy of 0.005 inch. Heavy cuts are taken at high speed, and, although the photograph shows conventional carbide tools being used, "throw-away" carbide tool bits are now actually being employed. With the "throw-away" bits, it is not necessary to remove the tool-holders from the machine and so setting up holders has been eliminated, saving a considerable amount of time. Resharpener of cutters has also been eliminated, and the practice of using the "throw-away" carbide tips has proved most economical.

Four self-contained Magna drill heads on the machine in Fig. 10 are employed to produce eighty holes of 17/32 inch diameter around the flange of the case shown. Four holes are drilled simultaneously, the work being indexed twenty times during the operation. The base of the machine and the work-fixture were designed by Ryan tool engineers.

The Cincinnati Hydro-tel milling machine seen

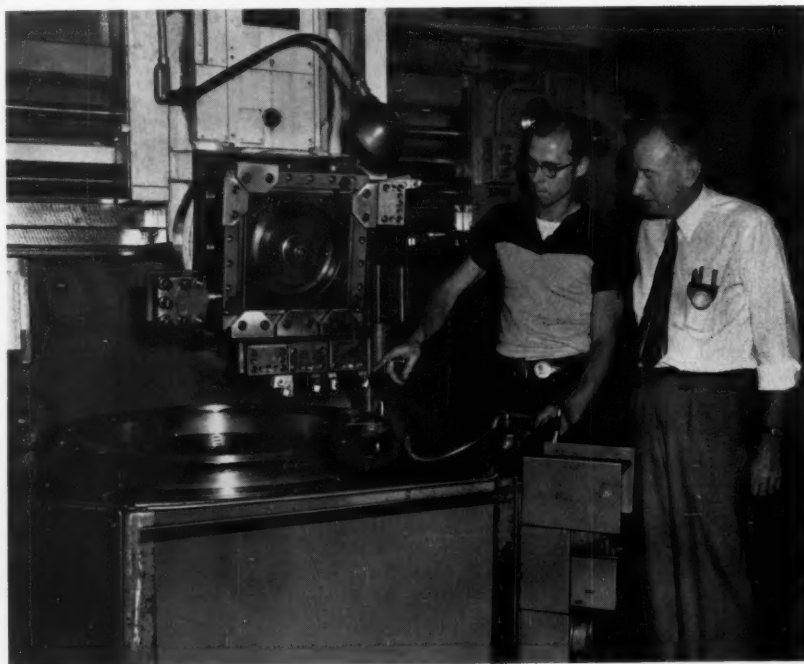
*Fig. 10. Eighty holes are drilled around the flange of a jet-engine component by this special machine which is equipped with four drilling heads that are used simultaneously.*





*Fig. 11. (Left) Hydro-tel operation in which forty-four lugs are cut around flanges of a jet-engine component, four flanges being milled simultaneously.*

*Fig. 12. (Right) Five cuts are taken at one time with this unique set-up on a vertical turret lathe equipped with a Bullard Man-Au-Trol.*



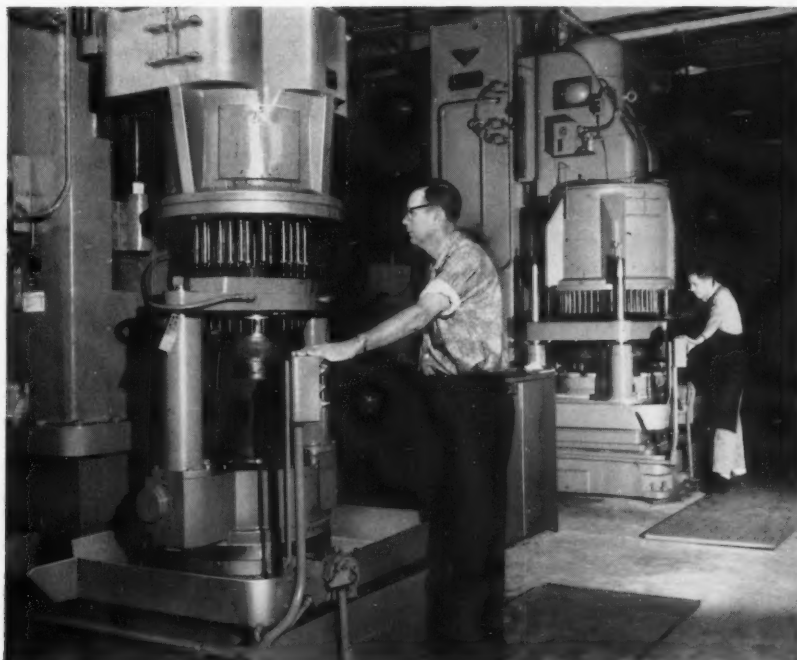
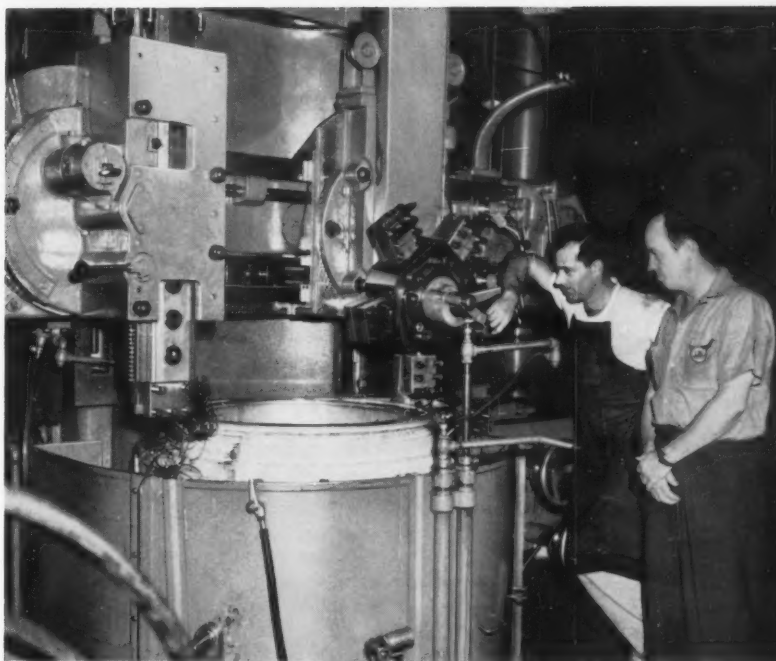
in Fig. 11 is employed for producing eleven lugs around the peripheries of four flanges of one engine part. A total of forty-four lugs are produced by a long side milling cutter as the stylus of the tracing head at the right of the machine follows the contour of a flat template.

Five tools mounted on one side of the square turret of a Man-Au-Trol-equipped Bullard verti-

cal turret lathe, as seen in Fig. 12, completely machine the flange of a component with two settings of the turret. Only one tool is used on the second setting. The machine is equipped with a hydraulic chuck, and the operation is completely automatic through the use of the Man-Au-Trol. With the latter equipment, the time for the operation is forty-five minutes, whereas without the



*Fig. 13. (Right) Another turning, facing, and boring operation performed on a vertical boring mill in which the two tool-heads are used at the same time.*



*Fig. 14. (Left) Two machines arranged for drilling eighty holes simultaneously around the flange of a jet-engine assembly. Cobalt drills are carefully inspected before installation to insure a satisfactory job.*

Man-Au-Trol two hours was required for doing the work.

Two heads on the King vertical boring machine illustrated in Fig. 13 are employed simultaneously for performing turning and facing cuts on a casting flange. After semifinishing, the weldment is normalized and then returned to the same boring machine for the taking of finishing cuts.

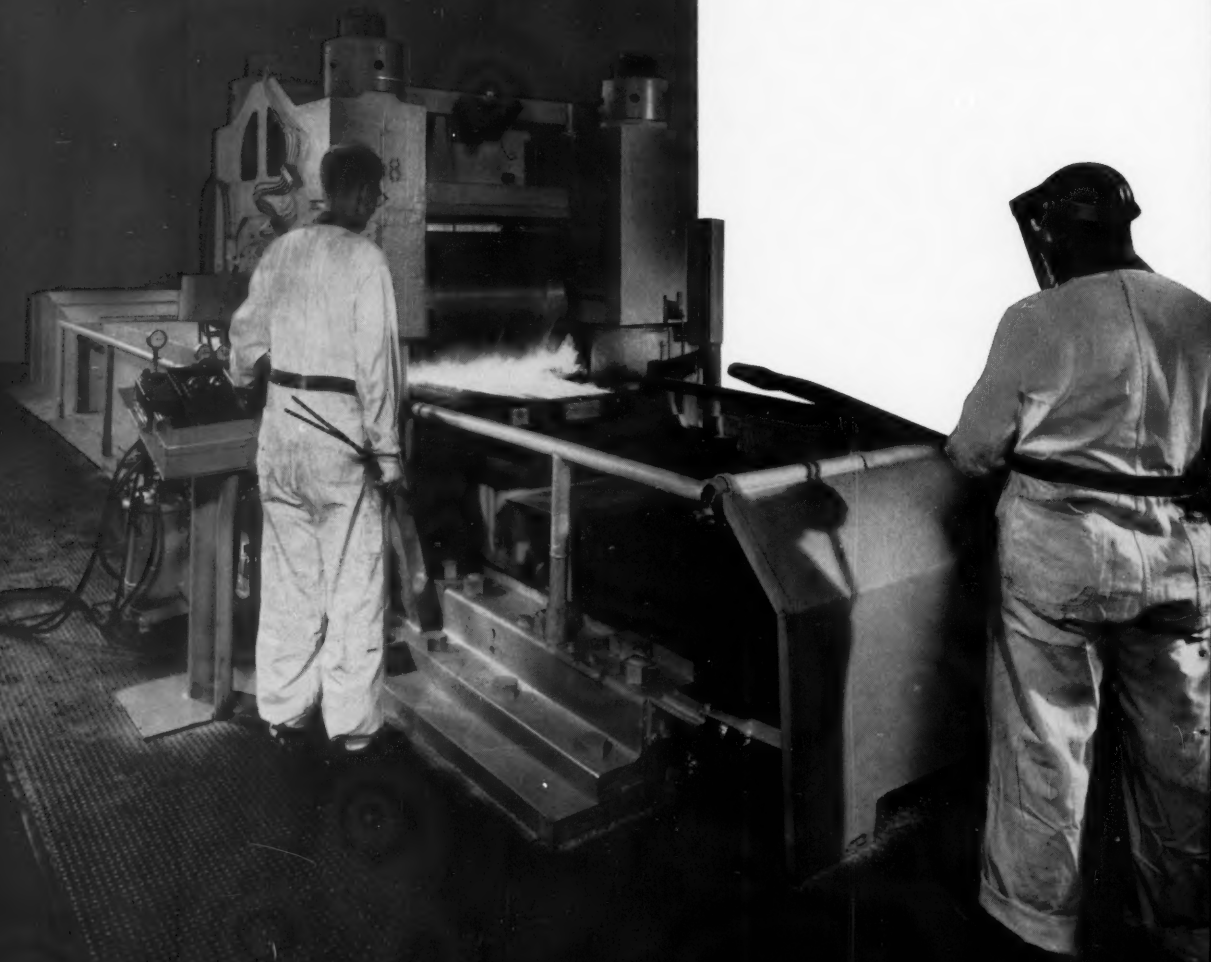
The machines shown in Fig. 14, built by the Michigan Drill Head Co., are both used for drilling eighty holes simultaneously in an assembly. The holes are 5/16 inch in diameter. Precision-ground cobalt drills are employed, and they are carefully inspected prior to installation on the machine because a faulty drill could necessitate scrapping of a part.

# CONTOUR ROLLING

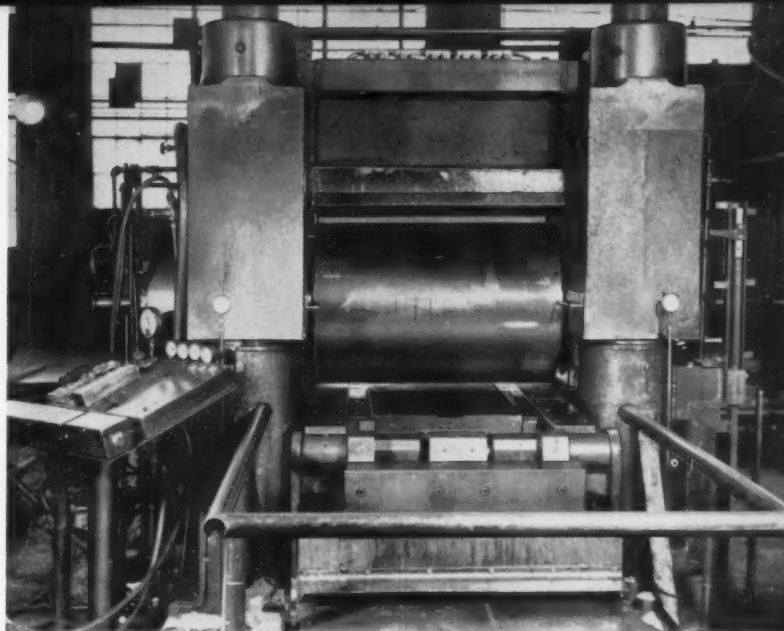
## *of Temperature Resistant Aircraft Components*

By FRANK J. ALTMANN  
Engineering Manager  
Aeronautical Division  
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Integrally stiffened skins, solid titanium propeller blades, and jet-engine rings are some of the aircraft parts recently produced at A. O. Smith by contour rolling—a unique and economical method of distributing metal. Precision forging, advanced welding processes, and carefully controlled heat-treatment methods are also used.



*Fig. 1. Front view of special contour rolling mill shows 30-inch diameter pressure-roll which can be adjusted vertically.*



**H**IGHER speed aircraft and missiles are increasing the demand for stronger and more heat-resistant metal structures without sacrificing lightness. Maximum strength-to-weight ratio depends on judicious selection of materials and ingenious design. Also, economy depends on optimum utilization of raw material, with necessary stock removal held to a minimum. Extensive use of materials such as stainless steels and titanium alloys, having greater strength at elevated temperatures, makes minimum stock removal more of an economy factor than has been the case with aluminum or magnesium.

The Aeronautical Division of A. O. Smith Corporation, Milwaukee, Wis., has perfected a unique process for economically displacing metal to provide strong, light parts requiring practically no subsequent machining. Called contour rolling, the process is sometimes combined with precision forging, welding, and heat-treating to fabricate various aircraft components.

In contour rolling, a special mill—seen in the heading illustration—having a large adjustable pressure-roll mounted above a flat reciprocating platen is used. A die having the desired impressions, whether they be serrations, ribs, or other configurations, is mounted on the platen. As the die passes under the roll, heated metal clamped to the die is flowed into the impressions. The mill, rated at 1800-ton capacity, was designed and built by A. O. Smith Corporation for the Air Force.

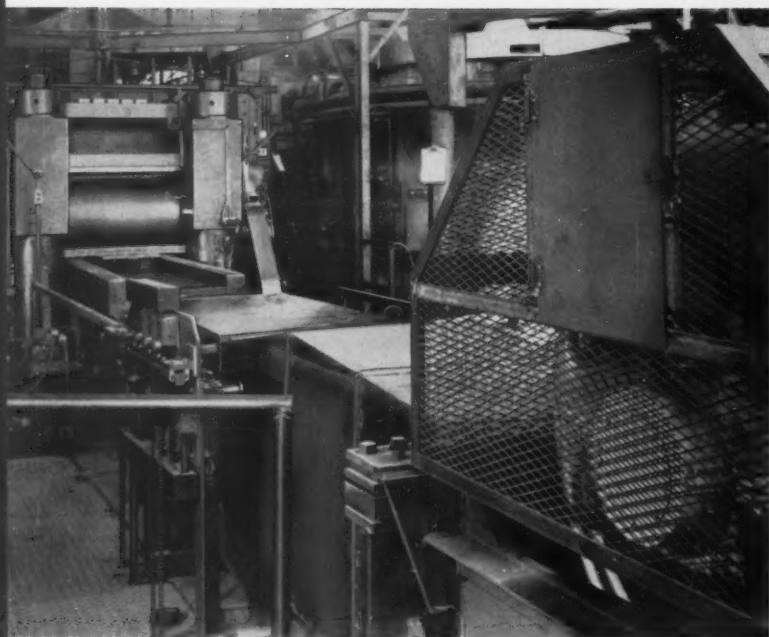
All malleable structural metals can be contour rolled, including steel, magnesium, aluminum, and titanium. Surprisingly, steel can be contour rolled faster than the other metals. This is because titanium and aluminum are more resistant to deformation at their respective forging tem-

peratures, while steel can be heated to higher temperatures and made more plastic. On the existing 1800-ton mill, parts up to 27 inches wide by 60 inches long can be rolled. Reductions as high as 87 per cent have been obtained, with an average of 50 per cent.

The pressure-roll, which is 30 inches in diameter, is supported in bearings which are mounted in a head, Fig. 1, that can be moved up or down in controlled increments to permit making several passes, when required. In operation, the roll is raised to clear the heated metal as the platen moves to the rear. On the return stroke of the platen, the roll is lowered onto the clamp, and the material flows into the cavities of the contour rolling die.

Part thickness is precisely controlled by 6-inch wide "spanks"—hardened and ground rails mounted along both sides of the die, on which the roll bears to maintain the desired clearance between roll and die. Thus far, 0.050-inch thick steel is the approximate minimum finished part size that has been processed because of the rapid increase in pressures required to roll thinner sections.

For most parts, only one pass of the die beneath the roll is required. Work-pieces requiring transverse configurations must be completed in one pass. However, on certain products, depending on the material and amount of reduction desired, as many as four passes have been made—reheating the metal between each pass or lowering the roll between passes with one heat. To produce integrally stiffened aircraft skins, investigations are being conducted to determine the height of rib that can be contour rolled on specified thicknesses of material. In one instance, starting with a 1/4-inch thick slab of steel, ribs 1/4 inch high



**Fig. 2. Reciprocation of platen on contour rolling mill is obtained by linkage connected to the mechanical drive located at the rear of the mill.**

by 3/32 inch wide were formed on a 1/10-inch thick base.

The contour mill has an all-mechanical drive, power being transmitted by means of a V-belt, gear transmission, camshaft, and rocker arm located at the rear of the mill, Fig. 2. Linkage reciprocates the platen through a 6-foot stroke at a speed of 180 feet per minute. An air-operated disc clutch is provided for disconnecting the drive. Cams, linkage, and air-actuated eccentrics permit vertical adjustment of the roll.

While the pressure-roll was originally power driven, it has been found that better results are obtained with it serving as an idler. However, an air motor is provided to rotate the roll for lubrication purposes. The reciprocating platen on which the die is mounted slides on a flat bed that is supplied with high-pressure lubrication and plastic interfaces to prevent galling.

Good die life has been encountered—thousands of steel propeller components being made on a single die made from AISI 4340 steel. A smooth working surface is maintained on the roll by resurfacing periodically. In resurfacing, the end areas of the roll which contact the spanks are turned down, and hardened chromium-nickel steel rings are shrunk fit into place. A powdered graphite lubricant suspended in a slurry of kerosene, water, or oil is sprayed or swabbed on the die during contour rolling.

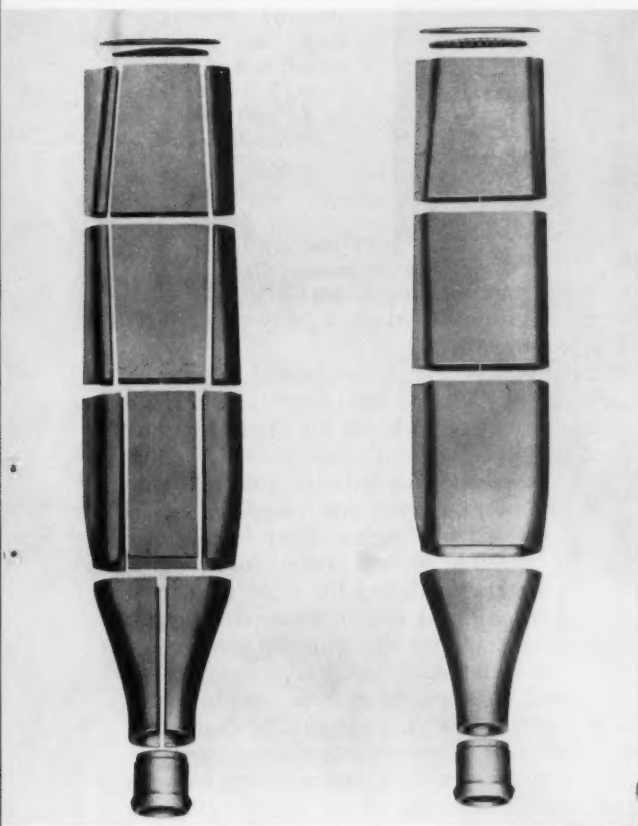
Contour rolling has been used by A. O. Smith since World War II to produce steel propeller blades, landing gears, engine mounts, bulkheads, and other aircraft parts. Many of the parts were

previously machined from aluminum, and have been redesigned to contour-rolled weldments. Fig. 3 illustrates the individual parts of a typical steel propeller blade, and the major sub-assemblies (right) prior to being joined by lateral flash-welds. This particular blade, 20 inches wide, is subsequently assembled into a propeller over 19 feet in diameter. Each blade is fabricated from sixteen structural components and incorporates fourteen flash-welds and one fusion-weld. The sequence of operations involved in producing a typical edge section is seen in Fig. 4. Processing starts with a round bar, followed by two pre-forges, a splash forge, contour rolling, and folding operations.

Now, the process has been successfully applied to the contour rolling of aircraft parts made from titanium alloys. Fig. 5 shows one titanium-alloy segment. Two of these contoured segments are contour rolled in one pass, side by side, from 7/8-inch thick by 13-inch wide and 27-inch long stock. When formed into semicircular shape and flash-welded together in an inert argon atmosphere, these segments become jet-engine rings.

Another example is the fabrication of solid titanium-alloy propeller blades, such as the one seen in Fig. 6. The propeller, which was designed to operate at very high speeds, is 12 feet in diameter, with each individual blade being approximately 6 feet long and having a maximum chord width of 20 inches. The face and camber sides are symmetrical about the center line, with a maximum foil thickness of 0.910 inch. Each blade is fabricated by flash-welding two components,





**Fig. 3. (Above) Steel propeller blade fabricated from sixteen components (left), and sub-assemblies (right) that are joined by flash-welding.**

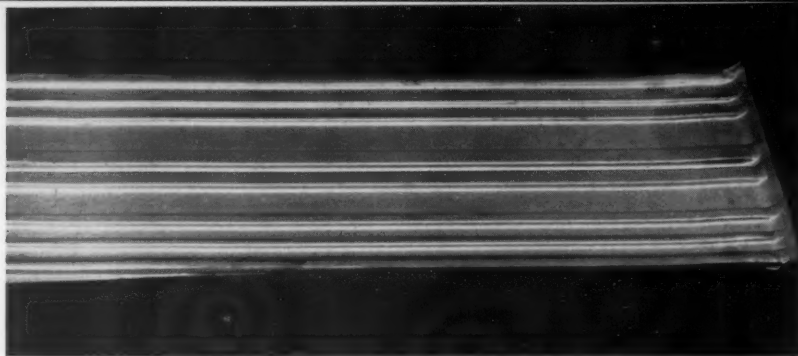
**Fig. 4. (Right) Round bar seen at top is pre-forged, splash forged, contour rolled, and folded to produce edge section for propeller (Fig. 3).**



an inboard (root and shank) and outboard member, both made from a titanium alloy containing approximately 4 per cent aluminum and 4 per cent manganese.

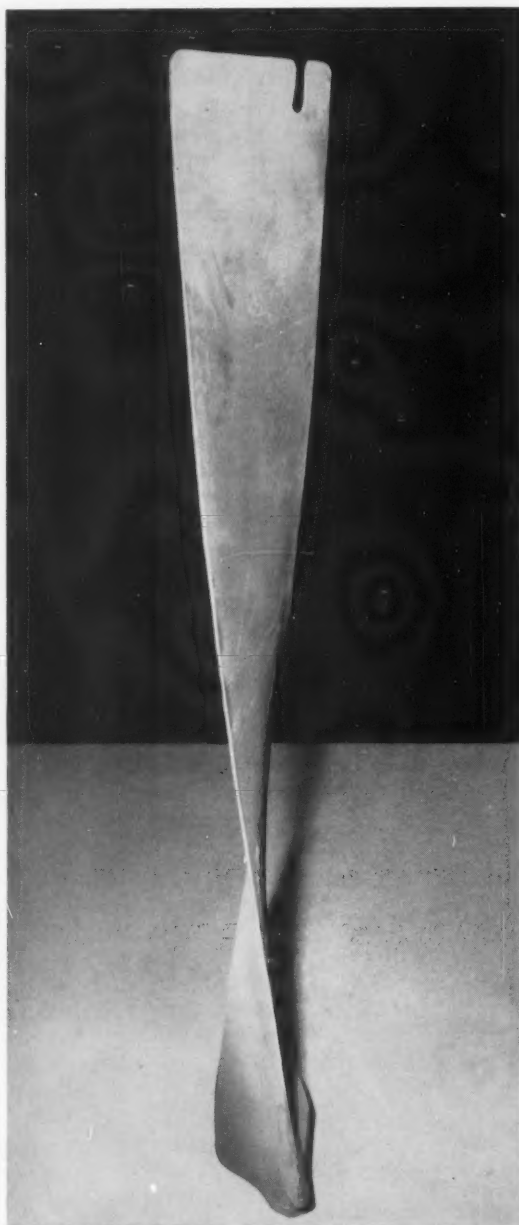
The inboard component is forged from a billet 8 5/8 inches in diameter, by upsetting and both forward and backward extrusion. The outboard component is forged, contour rolled, and twisted from billets 7 1/2 inches thick by 11 1/2 inches wide and 10 1/2 inches long. Precision forging of both components is accomplished on a 9000-ton mechanical forging press, Fig. 7, built by the A. O. Smith Corporation. This press has a 36-inch crankshaft with a 6-inch throw, and is capable of making fifty strokes per minute. It is designed to be capable of exerting extremely high forging pressures, and the pressures can be directed on relatively small compact areas.

Outboard component billets are forged in closed impression dies to provide an "ear" for clamping the part during contour rolling, and to provide a sufficient volume of properly distributed metal for rolling the foil sections. Mild steel billets were used first to establish the volume requirements for forging the titanium alloy. Dies are preheated and maintained at a temperature between 300 and 400 degrees F., and their surfaces are sprayed with a mixture of graphite



*Fig. 5. Segments for aircraft jet-engine rings are contour rolled, two at a time, from 7/8-inch thick by 13-inch wide titanium-alloy plate.*

*Fig. 6. (Below) Solid titanium-alloy propeller blade, 6 feet long and 20 inches wide, after it has been contour rolled, coined, and twisted.*



and oil before each operation. The billets are coated with a powdered glass slurry which fuses during heating.

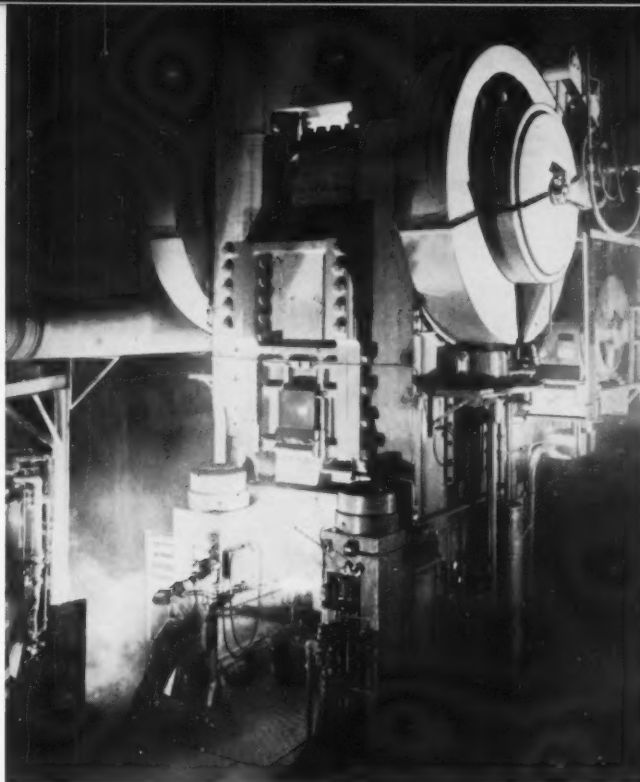
Billet furnaces, Fig. 8, are held at a temperature between 1700 and 1800 degrees F. The billets are heated three hours for the pre-forging operation, and one hour prior to final forging. Billet temperatures vary between 1660 and 1715 degrees F. for pre-forging, and from 1700 to 1735 degrees F. for final forging. After forging, the parts are cooled in air, grit blasted, and pickled. Flash is machined off, and the clamping ear on one end is machined to provide a positive grip during contour rolling. End gripping induces side flow of the material.

A forged outboard component is seen on the contour mill in Fig. 9. Reduction to final thickness, length, and width requires five passes plus a sixth coining pass, each pass requiring between 1000 and 1200 tons of pressure. As in forging, the die temperature is maintained between 300 and 400 degrees F. However, the roll is not heated. Graphite in oil is used on the die and roll, and powdered glass on the parts.

Initial contour rolling passes are made with the part temperatures ranging between 1650 and 1735 degrees F., while the final passes are made with temperatures from 1500 to 1600 degrees F. Heating time is progressively decreased as the thickness diminishes. Prior to the final pass, all blades are trimmed to width and length, and the entire surface is grit blasted, pickled, ground, and polished. A finish-rolled blade, trimmed to length and width, is shown in Fig. 10.

Coining and twisting of the outboard components are performed on a 1000-ton hydraulic press. The heavier root end of the blade is heated for one hour in a furnace maintained at 1575 degrees F., and then the entire blade is placed in a furnace held at 1700 degrees F. for one-half hour. The press die dwells on the part until the temperature drops below 1000 degrees F. to minimize possible distortion. In this operation, the mass of metal which has been used as the clamping ear during rolling is transferred from the face side of the blade to a position on the center lines of the outboard section. This triangular-shaped section is forged into an elongated diamond shape to match the cross-section of the

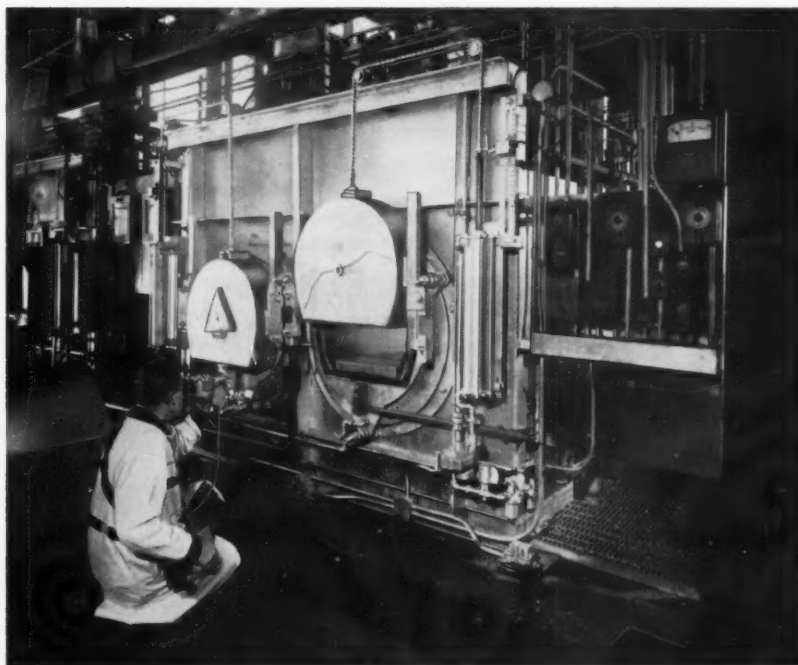
*Fig. 7. Mechanical press of 9000-ton capacity for precision forging of components that are to be subsequently formed by contour rolling.*



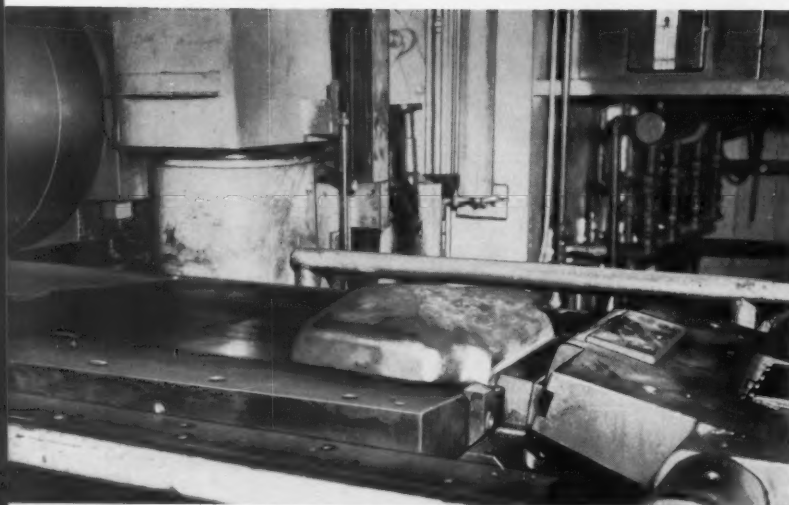
root shank component at the flash-welding face. The foil thickness is coined so that the outboard section becomes symmetrical about the chord lines, and the specified twist of approximately  $1/2$  degree per inch is introduced.

After blast cleaning, the blades are given a

fluorescent penetrant inspection, dimensionally inspected, and machined in preparation for flash-welding. Flash-welding (electrical resistance butt-welding) is performed on a special machine having a maximum capacity for joining steel parts end-to-end with a surface area of 50 square



*Fig. 8. Operator is using optical pyrometer to determine the temperature of billets in furnace prior to their removal for forging operation.*



*Fig. 9. Pre-forged titanium-alloy propeller blade section shown clamped to the reciprocating platen before start of the contour rolling operation.*

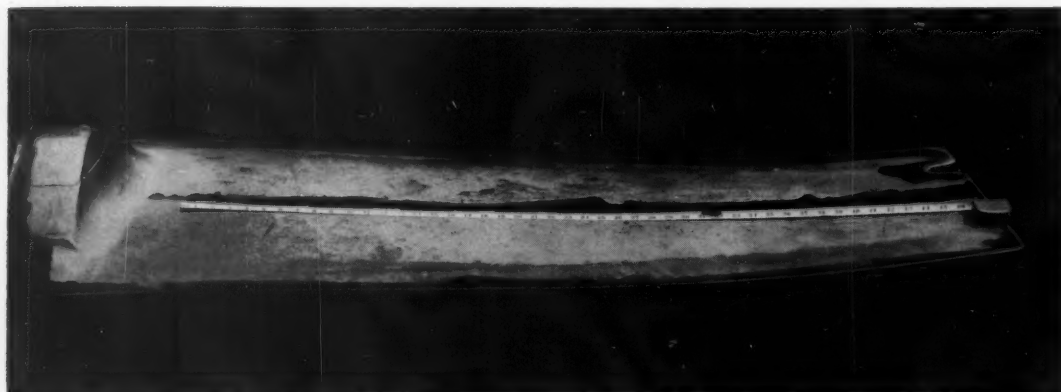
inches, based on a maximum current flow of 5000 amperes per square inch.

An inboard and outboard component for each blade are clamped in current-carrying fixtures and moved into the welding machine, Fig. 11, by means of transfer cars mounted on rails. One fixture is secured to a stationary platen on the machine, while the other is clamped to a movable platen. The movable platen is hydraulically operated and cam controlled. When the faces of the blade components have been brought into light contact, current is passed through the circuit to produce a flashing or arcing action between the adjoining metal surfaces. As the metal is heated to the fusion point, sufficient pressure (15,000 to 16,000 pounds per square inch for this part) is exerted to quench the arc and upset the material. Positive stops limit the travel of the movable platen for accurate length control.

Precise control of each welding operation is accomplished by plotting the variables on a Brush multi-channel recording oscillograph. The rate of platen travel is plotted against time on a second channel, and the voltage drop across the two parts being welded is recorded on the third channel. Required current, voltage, and platen travel rates for a sound weld are predetermined by destructive testing of initial or similar parts. The three-line graph produced for each weld serves as a permanent record that specified conditions were met. To prevent the entrapment of atmospheric oxides in the weld area, the operation is performed in a sealed envelope that is purged of air and filled with an inert gas such as nitrogen or argon.

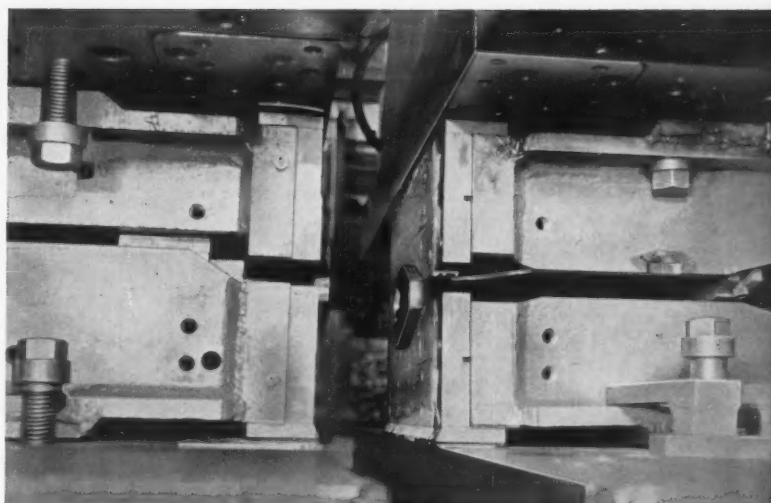
As soon as possible after welding, the blades are given an annealing heat-treatment. Radiographic, fluorescent penetrant, and dimensional

*Fig. 10. After final contour rolling pass and trimming operation, titanium-alloy propeller blade is ready for coining and twisting.*





*Fig. 11. Inboard and outboard components of propeller blade are here clamped in fixtures secured to the platens of 50-square-inch flash-welder.*

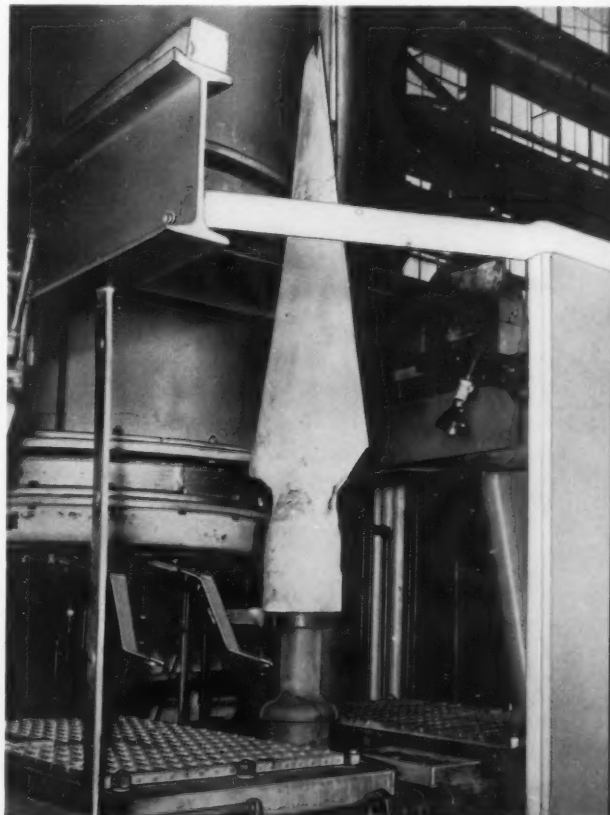


inspections are made, and the weld zone is contour-machined on a Pratt & Whitney Keller machine. After polishing, blast cleaning, and pickling, the blades are solution heat-treated, and quenched with water while clamped in dies. A blade mounted on a quenching stem is seen in Fig. 12, with a movable, vertical electric furnace in the background. The furnace is supplied with a protective gas atmosphere, and an elevator is provided to raise the part into the furnace bell or lower it into the quenching pit. Immediately after solution heat-treatment and quenching, the propeller blades are clamped in holding fixtures and aged for eight hours at 1000 degrees F.

Since contour rolling makes possible the full utilization of all the metal in each component, it is expected that the process will find applications in automotive, railroad, agricultural implement, and shipbuilding as well as aircraft industries. Resultant parts are thinned in moderately loaded areas and thickened in highly loaded areas. Also, the process yields the preferred grain flow and mechanical properties while providing the desired configuration. Through proper atmosphere control in heating, parts are generally used with surfaces in the as-rolled condition.

Another advantage is the precise tolerance control afforded. This is most important in the manufacture of hollow-steel propeller blades from the standpoints of weight and balance. For example, 0.001 inch of skin thickness spread over a typical blade can add approximately 100 inch-pounds in turning moment around the hub center. Controls developed at A. O. Smith have been instrumental in producing blades to 1/2-inch-pound tolerances. This is accomplished by weighing the hot part during contour rolling and making necessary roll adjustments.

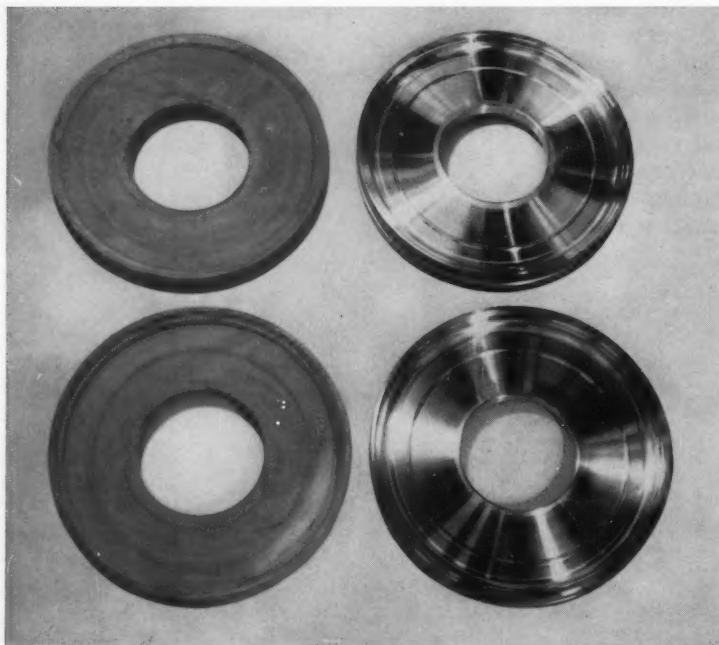
*Fig. 12. Set-up for solution heat-treating and quenching of propeller blades. Bell type furnace is seen at left in background.*



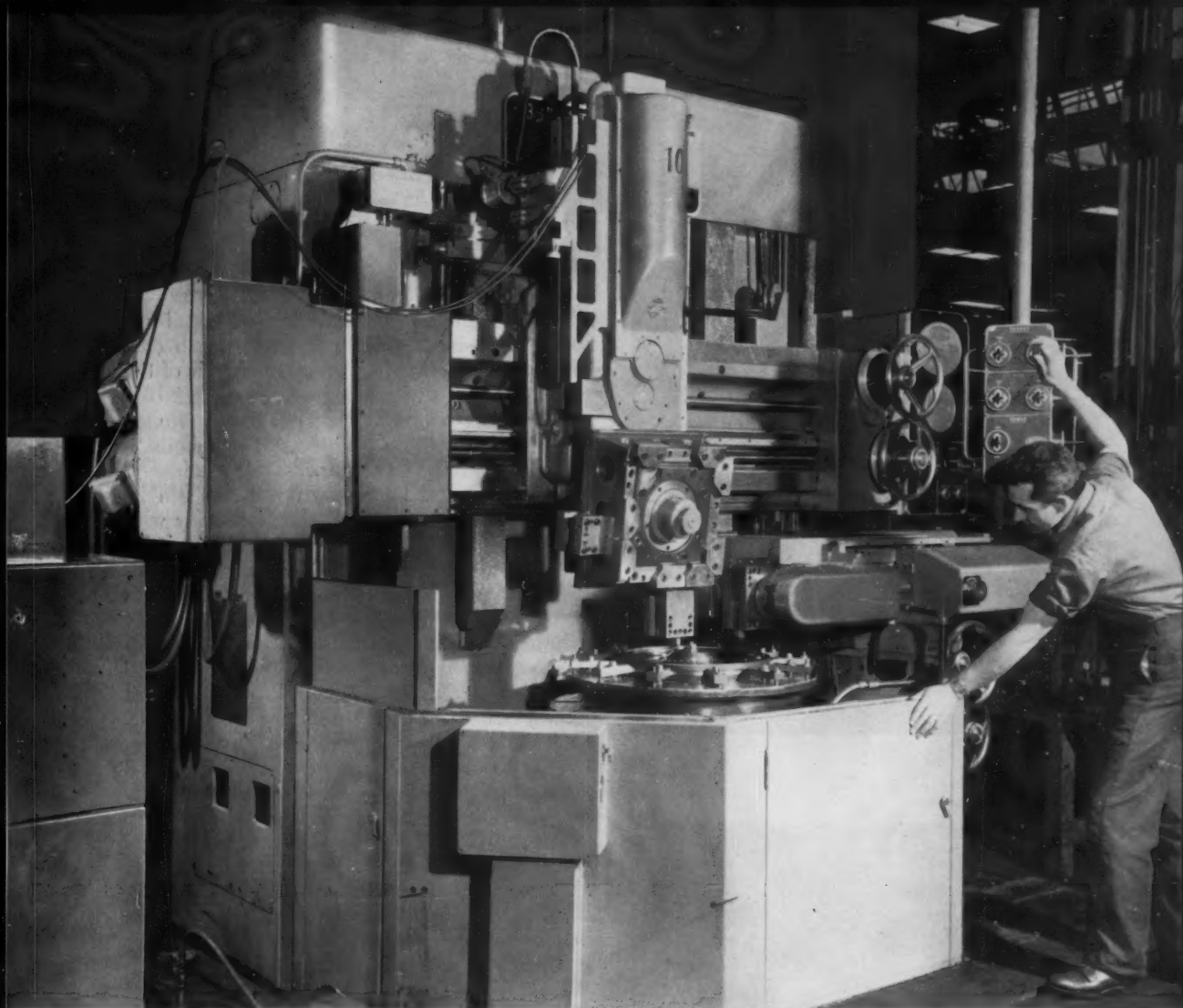
# JET ENGINE COMPRESSOR DISC PRODUCTION AT THOMPSON PRODUCTS

Output of forged steel compressor discs for aircraft jet engines has been speeded up by contour facing on vertical turret lathes equipped with Man-Au-Trol automatic controls and two-dimension tracer controls having magnetic tracing heads. Production has also been boosted by a unique application of continuous broaching to cut fir-tree serrations in compressor disc rims. In this set-up, the insert type broaching tools are carried on continuous chains and the work clamped to an indexing fixture.

By W. M. WILLIAMS, Manufacturing Manager  
Jet Division, Thompson Products, Inc.,  
Cleveland, Ohio



*Fig. 1. Compressor discs for jet engines are shown as forged (left) and after contour facing (right).*



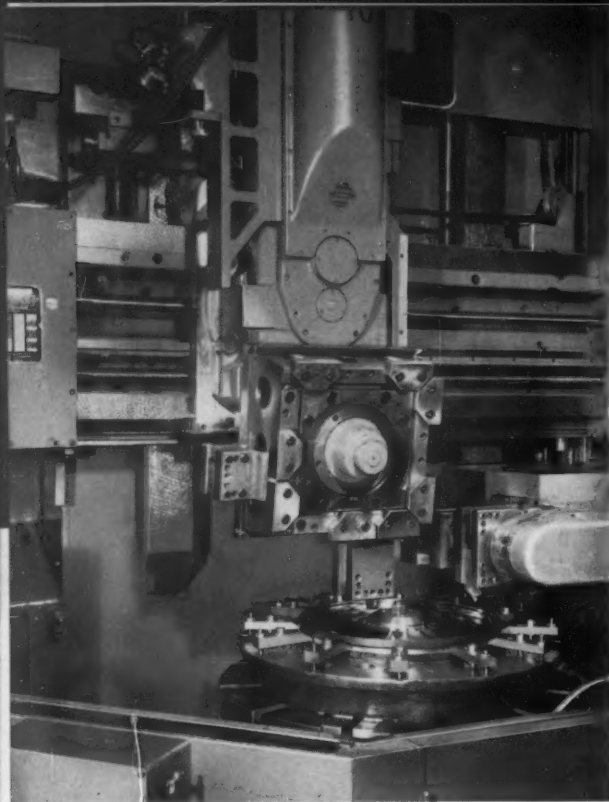
**I**NCREASED demand for aircraft jet-engine components made by Thompson Products has led to several improvements in manufacturing techniques. For example, the output of compressor discs has been increased by using new vertical turret lathes equipped with automatic controls and electronic tracers for turning, chamfering, and contour facing.

The jet-engine compressor discs are forged from heat- and corrosion-resistant, AMS 6415 steel. Each forging is approximately 20 inches in diameter and 1 5/8 inches thick at the rim. Front and back views of a forging are seen at the left in Fig. 1, while compressor discs that have been contour faced are shown at the right.

Contour facing is performed on Bullard 36-inch vertical turret lathes such as seen in the heading illustration and Fig. 2. Each machine is equipped with a four-sided, main turret head and an independent side head having a four-sided indexing turret. A Man-Au-Trol attachment on each ma-

chine is applied to the handwheel units of both heads, thus providing completely automatic operation of the heads through a pre-selected sequence of operations. Also, movements of the main turret head are controlled from a flat template by means of a General Electric magnetic tracer for profile cutting.

A pendant control, seen at the right in the heading illustration, permits the operator to conveniently select all functions from a single station. The feed or rapid traverse of each head can be actuated from corresponding levers on the pendant. By directionally engaging the feed levers singly or in combination, a continuous sequence of operations can be quickly performed. A direct-reading feed rate selector dial is provided on the pendant for each head and changes in feed rate can be made with the table rotating. Table rotation is controlled from a single jog-or-run lever and the desired speed is selected from another direct-reading dial.



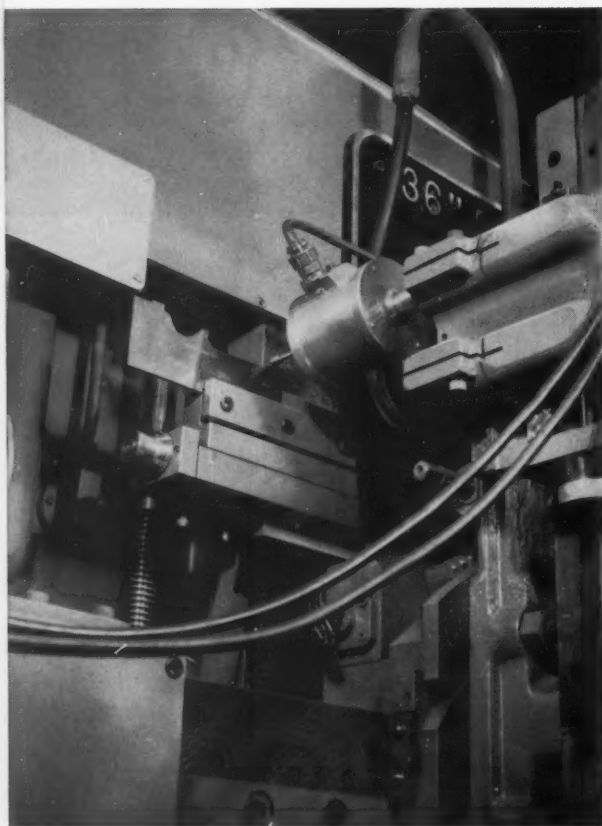
**Fig. 2. Close-up view of the vertical turret lathe seen in the heading illustration. Main head is at top center, and side head may be seen at the right.**

The main head consists of a saddle, swivel, turret-slide, and a power-indexing four-sided turret. Multiple-block tooling can be used in conjunction with boring-bars on all four faces of the turret. The turret is operated by a 1/2-H.P. motor, and power indexing can be controlled either manually from the pendant or automatically by means of the Man-Au-Trol attachment. Both vertical and horizontal operations can be performed by the side head simultaneously with those being done by the main vertical head. The side head turret is also power indexed.

Vertical and horizontal feed-shafts of the heads are used to electrically control and mechanically operate the Man-Au-Trol attachment. The attachment has a rotary indexing program-control drum that permits forty-nine possible changes of pre-selected operations in a machining cycle. Each index of the drum positions a row of pre-set pins to initiate the required functions. Final settings of the head strokes and compensation for tool wear are accomplished by micrometer dials.

Successive indexes of the program-control drum are initiated by two detector drums, one of which controls the vertical motion of the head, and the other, the horizontal motion. These drums are also mechanically driven from the feed-shafts of the heads, and each drum has forty-nine adjustable rotary discs for controlling the length of the head travel. The attachment is equipped with two levers—one for transferring the table speed selections from the pendant to the attachment, and the other for transferring feed selections. The feed-selection lever has three operating positions which permit automatic cycling, setting up, or manual operation.

The General Electric two-dimension tracer control provides automatic control of electric motors for two feed motions of the machine by the use of signals from a magnetic tracing head, Fig. 3. A signal is generated in the magnetic tracing head by the deflection of a stylus against a flat template having the desired profile to be cut on the compressor-disc face. Modifications of the tracer signals are accomplished by electronic circuits in a control panel, thus making the signals suitable



**Fig. 3. A stylus on the magnetic tracing head, in contact with the flat template, is employed to guide the tool to duplicate contour on work-piece.**



**Fig. 4.** Tool on main head (left) performs contour facing, while tools on side head (right) execute chamfering, facing, and turning operations.

for the control fields of amplidyne generators. The generators amplify the low-power signals from the control panel, and bring them to the proper power level that is required for operating the feed motors.

Two feed motors, electrically connected directly to the amplidyne generators, operate in the correct direction to guide the tool in a path duplicating the shape of the template. Adjustment of the rate of travel of the stylus along the template is provided by a dial-actuated potentiometer. Another potentiometer permits adjustment of the amount of deflection of the stylus and can be used to permit cutting slightly smaller or larger than the template, if desired. Voltmeter readings indicate any variation in stylus deflection or errors in tracing.

A third potentiometer is provided for guiding the stylus when operating with manual control. This is used for steering the stylus to the template when beginning a cut, or during any operation when the stylus is not contacting the template. Two more voltmeters indicate the voltage and direction of the two feed motors, and the motor voltage is an indication of its speed. A two-position selector switch determines the direction in which the tracing head travels.

The tool is fed across the work at a constant feed rate, regardless of the contour, thus providing uniform surface finish and chip thickness. However, the feed rate can be pre-selected or changed at any time during the cut. Only approximately eight ounces of pressure is required on the tracing-head stylus for adequate control of the cutting tool.

A work-holding fixture on the rotary table of each vertical turret lathe contains rest and spacer rings to support the compressor disc at the required height. Location of the work-piece is accomplished by a collet assembly which enters the previously machined bore of the forging, and the part is secured by twelve strap clamps which rest in an annular groove around the periphery of the disc, as seen in Fig. 4.

Rough and finish contour facing operations are performed in two continuous, completely auto-



**Fig. 5.** Fir-tree serrations for holding compressor blades are cut through the rim of the disc on this 15-ton continuous broaching machine.

matic cycles, with the tracer-controlled main head completing eighteen separate functions. These functions include rapid traverse and pre-selected feed rates of the head to the left, right, up, and down. The table rotates at 55 R.P.M. during rough contouring, and at 150 R.P.M. for finishing. Feed rates employed vary from 0.0156 to 0.125 inch per revolution.

Simultaneously, the side head automatically performs thirty-six functions including power indexing to position the tools on the four-sided turret and combination down and side movements to generate the required chamfers. Other operations completed by tools on the side head include facing the hub, rim, and other straight surfaces on one side of the compressor disc; blending fillets; and turning the periphery. Feed rates for the side head vary from 0.0052 to 0.0625 inch per revolution.

Similar operations are performed on the opposite faces of the compressor discs with identical vertical turret lathes. The diameters of many surfaces are held within plus or minus 0.001 inch of the specified size. Also, these surfaces are maintained concentric with the disc bore within 0.005-inch full indicator reading. Required surface finish is 63 micro-inches, r.m.s., maximum.

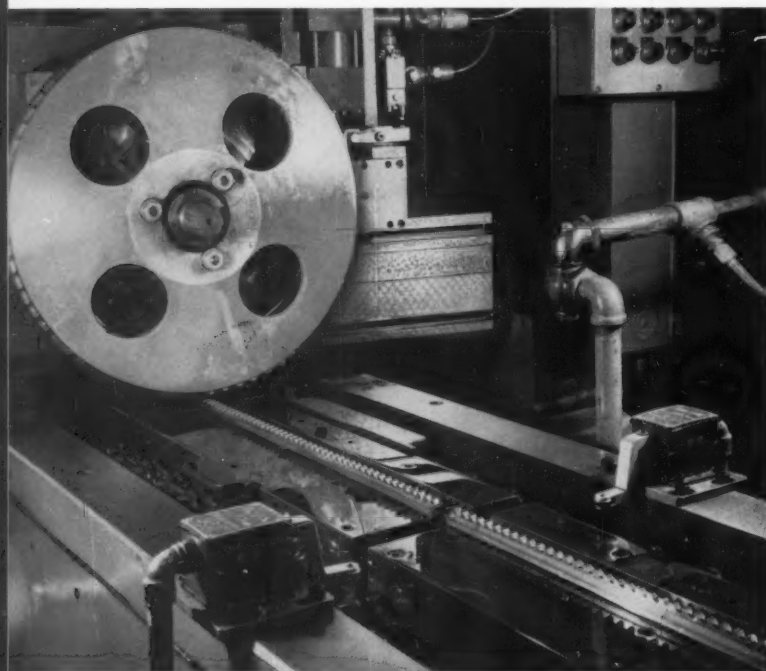
A unique application of continuous broaching is employed by Thompson Products to cut the fir-tree serrations in the peripheral rims of the compressor discs. In conventional continuous

broaching, a series of individual work-holding fixtures is moved by an endless chain past stationary broaching tools, usually mounted in a tunnel bridging the chain. This procedure has been reversed, and insert type broaching tools are mounted on the endless chains, while the compressor disc is clamped to a universal fixture mounted on top of the machine.

The set-up, illustrated in Fig. 5, consists of a Foote-Burt 15-ton continuous broaching machine and a universal, hydraulic indexing fixture that was made by Superior Machine & Engineering Co. This fixture can be pivoted to take care of broaching various cone angles, and raised or lowered to accommodate discs of different diameters. Also, the amount of indexing can be easily altered by means of change-gears.

Major advantages of this technique are: less floor space, lower cost, and faster production—since no non-productive return stroke of the broach is performed. Only a small gap is required between adjacent broach inserts, as seen in Fig. 6, to permit indexing of the compressor disc. Two complete sets of broach inserts are accommodated along the 360-inch length of the continuous chains, so that two serrations are completed with every revolution of the chains.

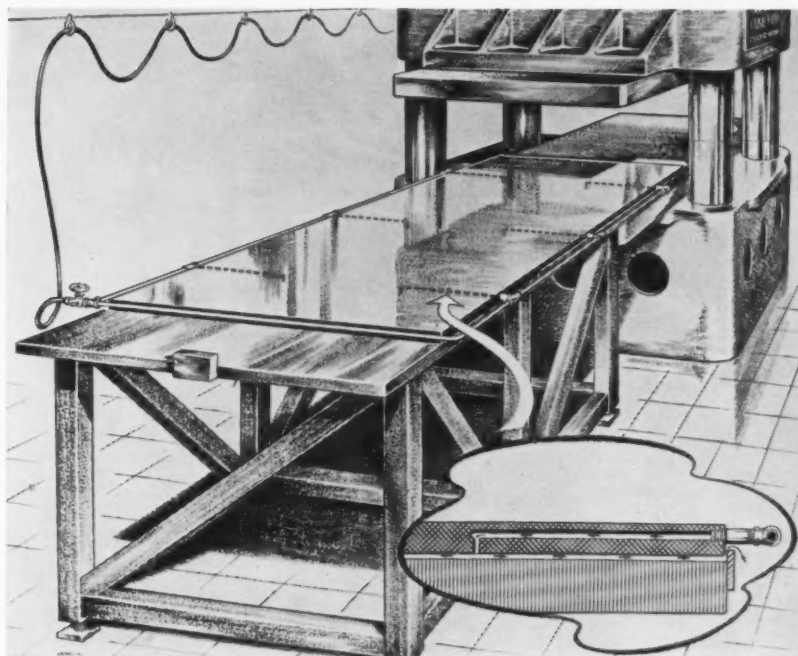
The broach inserts travel at 40 feet per minute. Chip loads vary from 0.001 to 0.003 inch per broach tooth, and the chips are carried away by a conveyor built into the machine.



*Fig. 6. Insert type broaching tools are carried by endless chains past compressor disc clamped to hydraulically indexed fixture.*

## Heavy Press Dies Floated on Cushion of Air

*Magnesium tooling plate on which heavy dies are mounted is floated above table by compressed air to facilitate moving die into press.*



**T**OOl engineers at Northrop Aircraft, Inc., Hawthorne, Calif., have developed an ingenious method of floating heavy dies into a press on a cushion of air. As shown in the accompanying schematic drawing, air under a pressure of 100 pounds per square inch is directed through a magnesium tooling plate to six evenly spaced orifices 1/8 inch in diameter. The air is forced out between the under side of the tooling plate and the top surface of the press table (as seen in the inset), thus floating the plate on a thin film of air.

Flanges on the sides of the table keep the plate in alignment.

A combined plate and die weight of up to 1500 pounds can be supported, and easily moved into position in the press with only fingertip pressure. When the die has been properly located and the air supply shut off, the plate settles onto the press table. Accurate positioning could be achieved by installing adjustable cams to automatically shut off the air supply at any desired point along the plate travel.

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### Chemical Compositions Prevent Icing

Conventional wing and tail anti-icing equipment on certain types of military aircraft may soon be eliminated. Chemical compositions that effectively prevent ice accumulation on airplane wings are being developed for the U. S. Air Force by scientists at the Armour Research Foundation of the Illinois Institute of Technology, Chicago, Ill.

The chemical de-icers are expected to point the way to significant cost and weight reductions in aircraft. The compositions can be brushed or sprayed on the areas of the airplane where ice accumulates, or applied in the form of tape.

### Why Air Power Costs More

The use and need for costly and complex electronic aids to maintain U. S. air superiority has grown spectacularly since World War II. During the 1940-1945 period, electronic systems represented 11 1/2 per cent of the man-hours required to build planes and only 16 per cent of their cost. In the 1950-1955 era, electronic systems represented 38 per cent of the man-hours and 48 per cent of the cost of the aircraft. For example, a heavy bomber in World War II had an electronic system weighing 1600 pounds and containing only 500 tubes. Today's bomber has an electronic system weighing 6000 pounds with 2140 tubes.

# UNIVERSAL



High production requirements have always been a prerequisite to economical impact extrusion because of the substantial tooling costs. Now, these costs have been reduced considerably, and set-up time is minimized by means of a universal die in which only the punch, die ring, stripper guide, and knock-out need be changed to produce different parts. Backward or forward extrusion—or a combination of both methods—can be performed with the same die.



# DIE CUTS COST OF IMPACT EXTRUDING AT NORTH AMERICAN

By FRANK J. PESAK, Senior Design Engineer  
North American Aviation, Inc.  
Los Angeles, Calif.

**I**Mpact extrusions of both ferrous and non-ferrous aircraft parts are attractive to the design engineer as well as to the manufacturer because of the high quality obtainable at relatively low cost. Also, wasteful scrap stock is eliminated, rapid production rates are possible, and the precise detail of the extruded parts minimizes the requirement for subsequent machining. Impact extrusions are produced without draft and have ideal grain-flow structure, comparable to forgings. Another advantage is that details are produced by compression rather than tension.

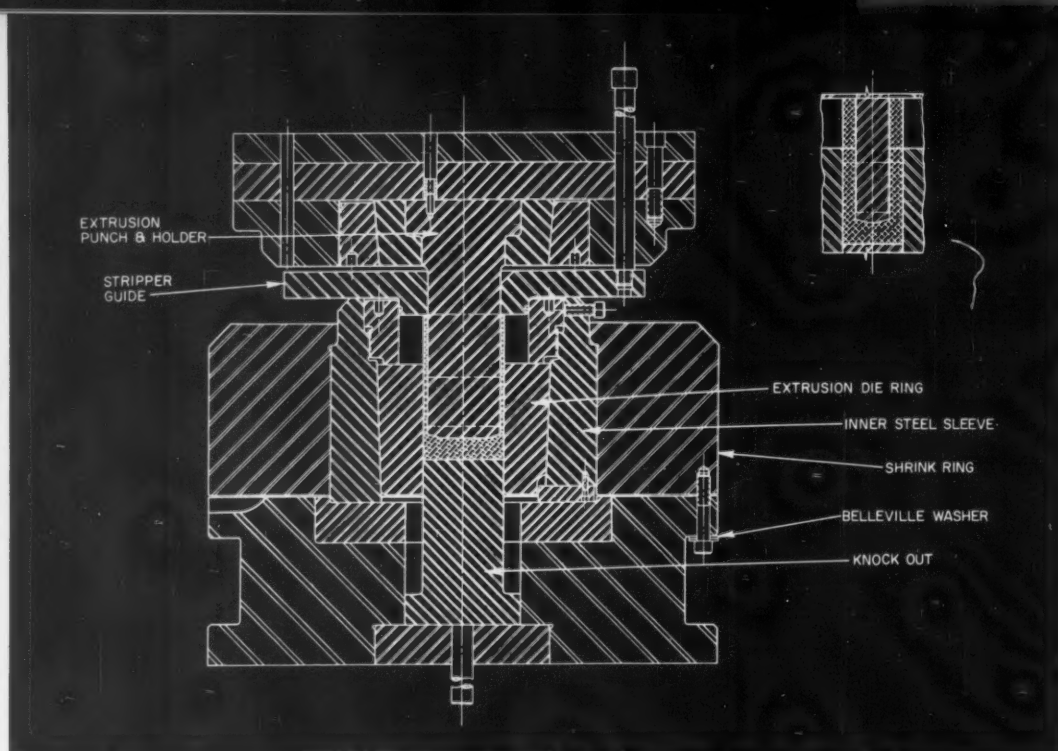
A major drawback to the wider use of impact extrusion in the aircraft industry has been the comparatively limited quantities of identical components required because of frequent design changes. The relatively high initial and maintenance costs of extrusion tooling could only be economically amortized when large production runs were needed. Now, however, North American Aviation has succeeded in substantially reducing the tooling costs—and minimizing set-up time as well—with the use of the universal impact-extrusion die seen in Fig. 1.

The outstanding feature of this die design is that various shaped parts can be produced by simply changing the punch, die ring, stripper guide, and knock-out. Thus, the amount of tooling required for different extrusions is reduced to a minimum, and the interchangeable components can be replaced within the die-holder without removing the holder from the press. The inset at the upper right in Fig. 1 shows how a smaller-diameter extrusion is produced in the same die by changing the necessary components.

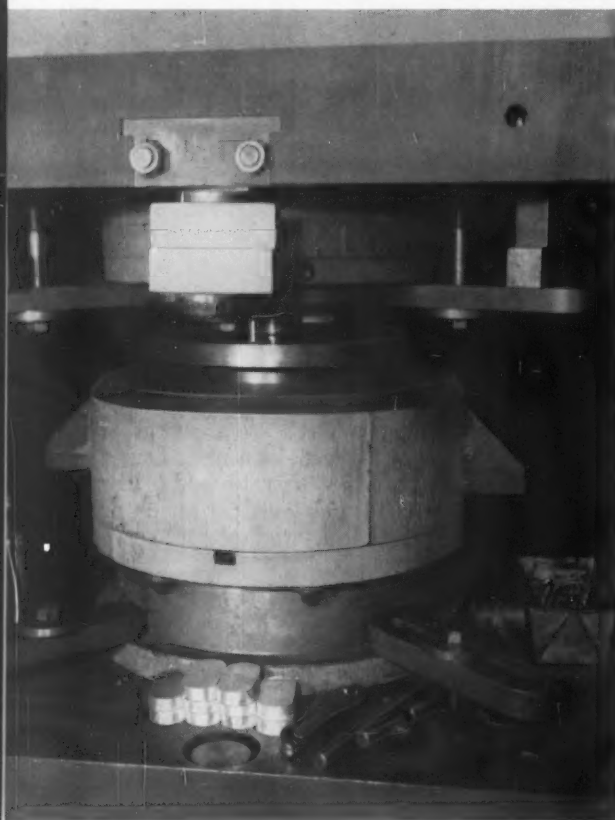
Basically, the tool consists of an outer shrink ring, a hardened inner sleeve, and the extrusion-die ring or cavity itself. The periphery of the die ring is tapered to fit the bore of the inner sleeve. A unique design feature is a combination stripper and guide ring, which, in addition to serving the conventional function of stripping the extrusion from the punch, also guides the punch when it has been lowered into the extruding position. This is accomplished by a hub on the under side of the stripper ring entering the bore of a guide ring threaded into the inner sleeve. With this arrangement, concentricity and wall thicknesses of the extrusions are accurately maintained without the need for precise leader pins to tie the punch and die together.

The threaded guide ring also holds the extrusion-die ring in the required position in the inner sleeve. A knock-out serves a dual purpose in that it supports the slug throughout the extrusion cycle and also automatically ejects the extrusion from the die ring at the completion of the cycle by means of a mechanism within the bed of the press. A standard head is employed for attaching the punch, punch-holder ring, and stripper-guide ring to the press ram.

Another advantage of the universal die is its safety feature, which eliminates any hazards to the operator or other personnel in the area. The die-holder is constructed so as to allow sufficient depth to entirely enclose the punch throughout the extrusion cycle. In fact, approximately 95 per cent of all working surfaces are enclosed during the initial impact. Fig. 2 shows the universal die in its closed position, and a completed extrusion,



**Fig. 1. Universal impact-extrusion die requires changing only punch, die ring, stripper guide, and knock-out to produce different parts.**



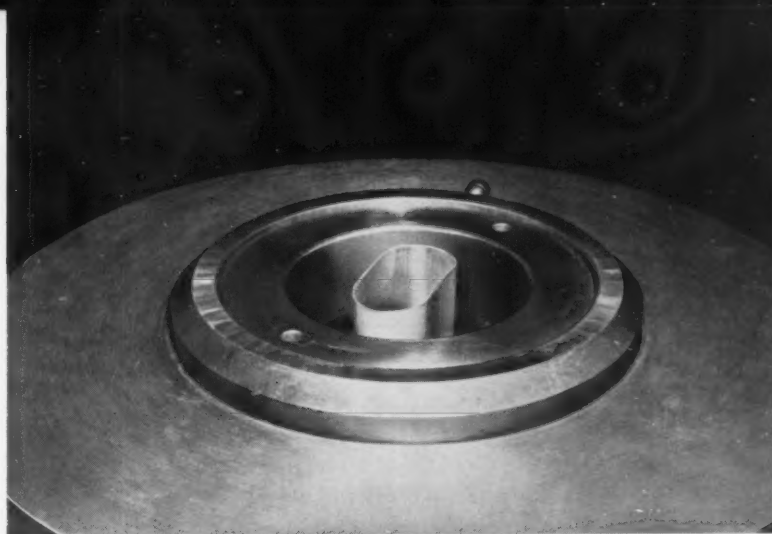
before it has been automatically ejected from the die, is seen in Fig. 3.

Possibility of premature fracturing or cracking of the die is reduced by fabricating the die so that the die ring is preloaded. This is accomplished by shrinking the outer ring (made from SAE 4340 steel) over the inner sleeve. The inner sleeve is made from a high-carbon, high-chromium tool steel that is heat-treated to withstand the exerted pressures and wear. Further preloading of the die ring or cavity is obtained by proper tool assembly and is controlled by the depth to which the die ring is inserted in the inner sleeve.

Another outstanding feature of the universal die is its capacity to produce both backward and forward extrusions—as well as parts made by a combination of both methods. Thin-wall tubular parts having heavy flanges or straight tubular shapes of considerable length are normally produced by forward extrusion, and pierced slugs or billets are used. Typical forward extrusions made from aluminum alloy are illustrated in Fig. 4. These parts have been subsequently finished by bending, swaging, or drilling. Unlike backward extrusions, length-to-diameter ratios

**Fig. 2. About 95 per cent of all working surfaces of universal die are enclosed during initial impact as a safety feature.**

**Fig. 3. (Right)** Open position of universal die shows completed aluminum-alloy impact extrusion before it has been automatically ejected.



**Fig. 4. (Left)** Aluminum-alloy parts made by the forward-extrusion method and subsequently finished by bending, swaging, or drilling.

**Fig. 5. (Right)** Slug shown at right is made from SAE 4130 steel, and cup-shaped part, at left, is produced by backward extrusion of the annealed slug.



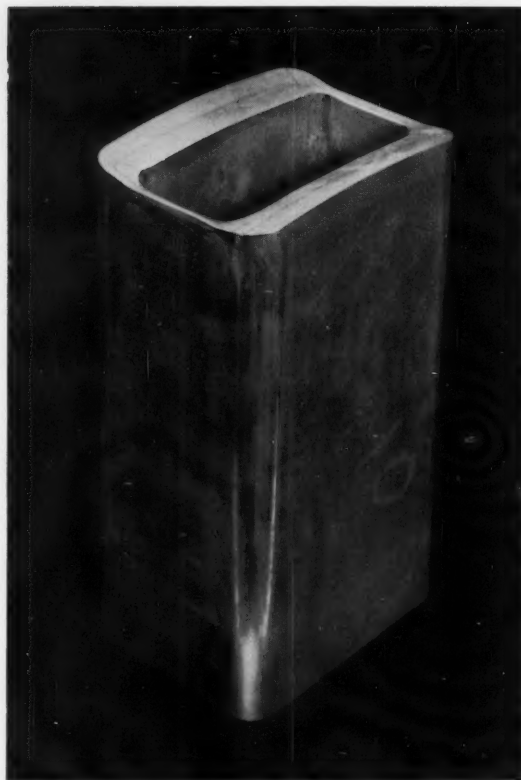
**Fig. 6. Impact extrusion having two thin and two thick sides illustrates possibility of producing parts having balanced wall-thickness deviations.**

may exceed 200 to 1 for forward extrusions, depending primarily on the working area of the press.

Thin-wall parts having a closed end are formed by backward extrusion. The production of such parts is restricted by tooling capacities which are controlled by the type of material to be extruded, the percentage of reduction to be effected, and the area of the base of the part. Backward extrusions having a length-to-diameter ratio of 6 to 1 are not uncommon. In fact, length-to-diameter ratios up to 12 to 1 are possible with certain aluminum alloys.

A typical part extruded from an SAE 4130 steel slug by the backward method is illustrated at the right in Fig. 5. Proper material preparation prior to extrusion is important. The use of phosphate coatings, soapstone, molybdenum disulphide, or similar lubricants provides exceptional surface finishes and improves production efficiencies. Isothermal annealing of the slugs insures minimum tensile properties of the low-alloy types of extrudable steels. However, the high tensile properties of steel, even in the annealed condition, restrict the length-to-diameter ratio to 4 to 1 or less when the reduction exceeds 80 per cent. A combination of the backward and forward methods can be used to extrude symmetrical thin-wall parts having a solid center section. Solid billets or slugs are used.

In general, impact extrusions should be symmetrical in shape to insure equalized pressure distribution on the die. Although a constant wall



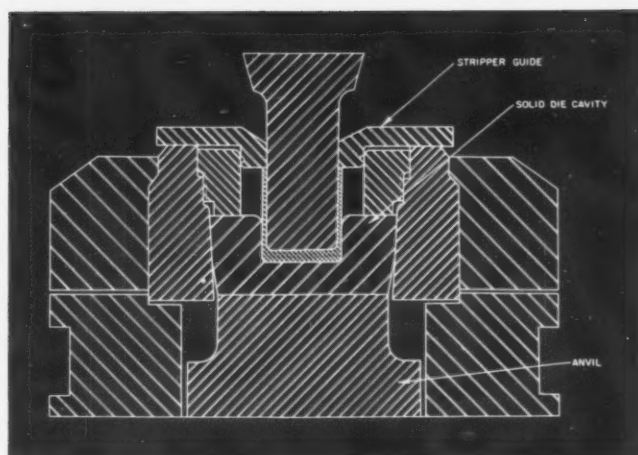
thickness (not bottom thickness) is advantageous, some parts having balanced wall-thickness deviations can be successfully extruded. For example, Fig. 6 illustrates a part of rectangular cross-section formed by backward extrusion and having a combination of thin and thick walls. It is to be noted, however, that the opposite walls have equal thickness. These parts, made from 7075-O aluminum alloy, were extruded by heating the



**Fig. 7. Flash-free outside corners on this aluminum-alloy part show advantage of performing backward extrusion in dies of the closed-cavity type.**



**Fig. 8. Closed-cavity die adapted to universal tool-holder. A cavity of comparatively light section should have wall-to-bottom thickness ratio of 2 to 1.**



slugs to a temperature between 300 and 400 degrees F. Most aluminum and magnesium alloys, as well as low-carbon and low-alloy steels, are extruded successfully on a production basis with unheated slugs.

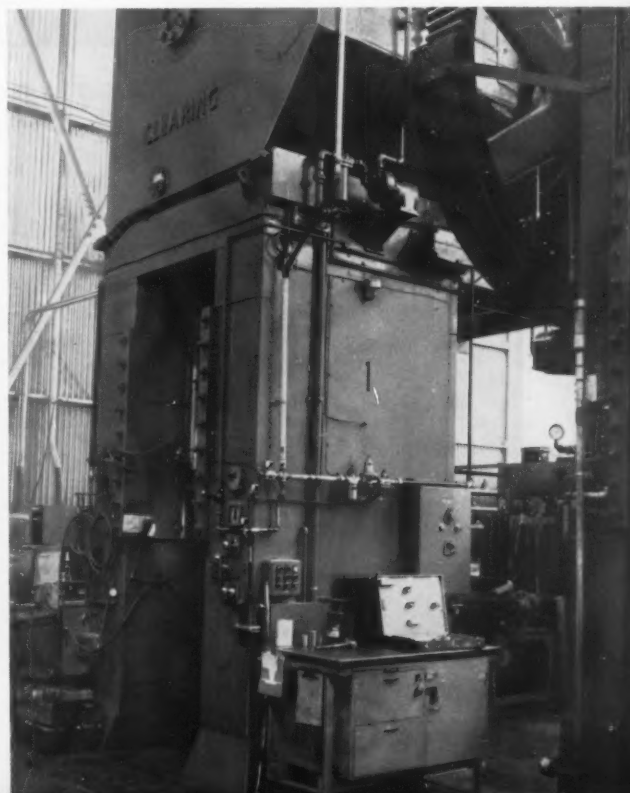
Backward extrusions can be produced either in dies having a positive knock-out (Fig. 1) or in dies of the closed-cavity type having a solid bottom. A closed-cavity die permits extruding parts to specified outside corner radii, without the flash condition normally characteristic of extrusions made in dies having knock-outs. The flash-free outside corners on a 6061-O aluminum-alloy part produced by backward extrusion in a closed-cavity die can be seen in Fig. 7.

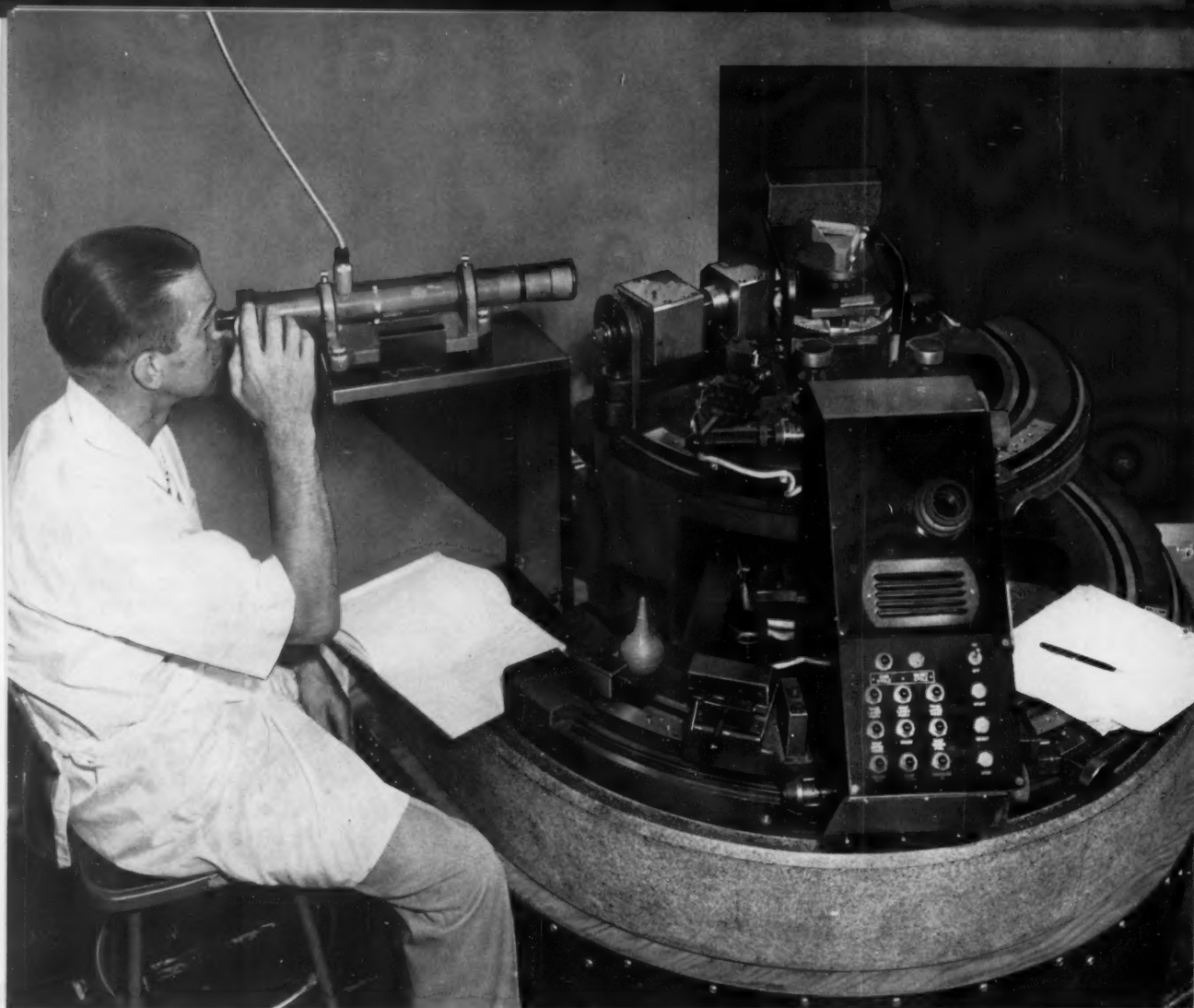
Closed-cavity dies can be adapted to the same universal tool-holder, as shown in Fig. 8. The use of these dies has its limitations inasmuch as ejection difficulties exist. Some draft in the extruded part is evident, which is a result of the die-cavity draft provided for easy withdrawal of the part. Also, life of the die is comparatively short. However, much success has been attained with the universal design shown, having the closed-cavity die resting on an anvil.

The complex accumulation of impact, tensile, and compressive stresses to which the tool is subjected necessitates an allowance for the "breathing" of the die cavity, rather than the rigidity characteristic of most massive die designs. A lack of compensation for this requirement may result in premature fracturing of the die. The use of a comparatively light die cavity is recommended, with proportions as illustrated, having a wall-to-bottom thickness ratio of about 2 to 1. Also, the provision of a 1-degree taper, ground on the outside of the closed-cavity die as shown in Fig. 8, used in conjunction with an anvil supporting base, has substantially reduced tooling failures when employing this type of design.

Extrusions are produced at North American on presses varying in capacity from 150 to 1000 tons. The selection of a particular press depends on the size and shape of the part, and the type of material being extruded. Horizontal and vertical presses of both the mechanical and hydraulic types may be used. Fig. 9 shows a Clearing 1000-ton mechanical press that is used for impact extruding on a production basis.

**Fig. 9. Typical of presses used for impact extrusion is this 1000-ton mechanical press. Hydraulic types are also being employed successfully.**





**C**ONTROL systems for intercontinental guided missiles call for manufacturing precision far greater than that found in conventional aircraft. A case in point concerns hobbing the teeth of gear sectors for Northrop Aircraft's new Snark SM-62.

This missile, powered by an Allison turbo-jet engine, has an advanced airborne guidance system, and operates at high altitudes and high speeds. The air-breathing Snark has been under proving tests on the sea lanes of the Air Force's guided missile range off the coast of Florida.

The sectors, of which there are eight per missile, with four different components involved, are part of the mechanical medium of the guidance system for actuating the reflecting surface which picks up the star image. Width of the sectors varies from a 2-inch to a 4-inch face. Teeth are 14 1/2-degree involute 0.050-inch circular

pitch. The largest of the four sectors has seventy-three teeth. Location of the tooth form on the periphery of the sector has to be accurate to 5 seconds of arc without any cumulative error.

To generate the teeth, Northrop built the hobbing machine seen in the heading illustration. A granite foundation, polished to optical accuracy, makes the machine virtually vibration-free. The indexing arrangement, claimed to be the most accurate in the United States, utilizes the matching of fringe patterns in a self-contained Tyman-Green type interferometer system.

A sector is shown in position on the small, circular work-table of the machine in Fig. 1. The hob runs on a shaft behind the table, driven by a small (1/15-H.P.) motor. Initially, the gear sector is located against a dowel-pin in the table and clamped in precise relation to the hob. To establish the location of the first tooth form, the op-

# GUIDED MISSILE GEAR GENERATOR

## *Indexed by Counting Fringe Patterns*

By WARREN ASHENFELDER  
Test Equipment Engineer  
Northrop Aircraft, Inc.  
Hawthorne, Calif.

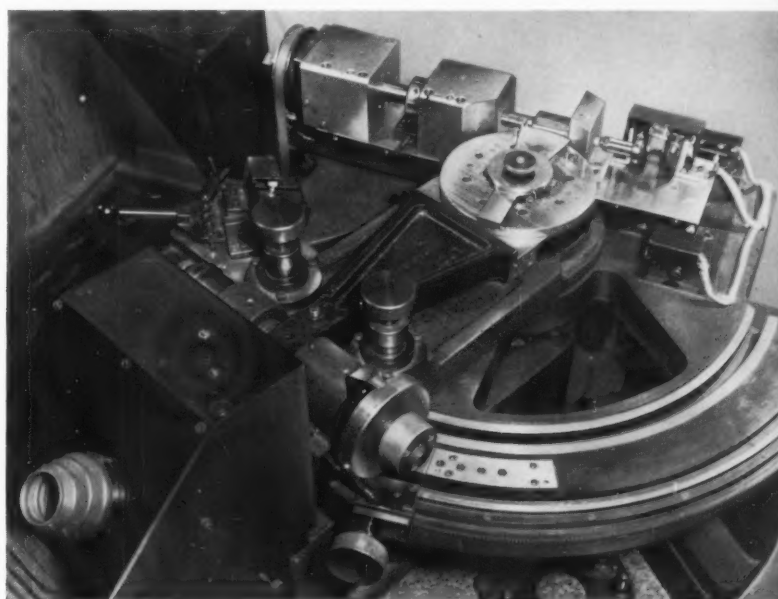
erator uses a Watts auto-collimator to sight the reflecting surface of a prism, temporarily mounted over the work-table, as can be seen in the heading illustration.

In the laboratory prototype of the gear generator, optical wedges were indexed back to the first tooth form in order to locate all other teeth of the sector. Cumulative error was avoided by this means, but the method was time consuming. Hobbing the sectors on a production basis re-

quired that the time expended had to be divided by a factor of five.

While the present model incorporates the mechanical principles of the prototype, the use of optical wedges was abandoned. Instead, a microscope was added (seen in use in Fig. 2) by which the fringe patterns of the interferometer could be readily counted as the operator moves the table spindle. A mercury light source is employed, with each fringe representing 0.000012 inch. "Rough"

*Fig. 1. The hob operates along the rear of the small circular table holding the gear sector.*





**Fig. 2.** *The operator uses the microscope to count the fringe patterns.*

location for each index is first made rapidly with a micrometer dial adjustment. This unit is visible in Fig. 1, immediately to the right of the microscope.

In addition to speeding up the indexing, the microscope dispenses with the need for an optical technician to run the machine. Any individual who is capable of counting carefully (assuming he knows enough about the optical field to know what he is counting) and who is capable of good workmanship can turn out a gear sector of prescribed accuracy. A check sheet is maintained by the operator in setting up the proper sequence of indexing adjustment.

Errors are further prevented by a warning system which sounds a buzzer if a proper adjustment has not been made. Another feature is a semi-automatic air-hydraulic regulation of depth of cut and relation of the sector blank to the hob. As would be expected, the machine is located in an isolated area of the Northrop missile machine shop, where conditions of temperature, humidity, and dust can be carefully controlled.

Optical means are also employed in inspecting the gear sectors and plotting calibration curves. The equipment used is illustrated in Fig. 3. A Hilger-Watts precision rotary table furnishes the index azimuth plane. Positioned on the table is an optical reference to which a Watts auto-collimator is zeroed. Any displacement of the table, within the field of the auto-collimator, can be read directly. This test unit, incidentally, illustrates Northrop's policy of adapting commercially available equipment wherever possible.



**Fig. 3.** *An auto-collimator and rotary table are used for inspecting and plotting calibration curves.*



## Multi-Purpose Machines Meet Production Needs

(Continued from page 171)

Practically every aircraft component made by Jack & Heintz contains several brazed parts. It was found that furnace brazing was slow and expensive because the entire part was needlessly heated and the fixtures used had a short life. Now, brazing of many parts is accomplished faster and more economically on the Tocco 15-K.W., two-coil, induction heating unit, Fig. 8. Parts to be brazed are placed on fixtures within the water-cooled heating coils. For silver soldering, the parts are heated to about 1200 degrees F., and for copper soldering, about 1950 degrees F. A typical brazing cycle requires about five seconds for positioning the part, and fifteen seconds to heat the parts to the required temperature.

In certain operations, the expansion resulting from induction heating facilitates assembly of mating parts, and, in some instances, the operation combines assembly with annealing. Over twenty parts, ranging from a tiny solenoid core to a 6-pound fractional horsepower core, are being induction brazed at present. Brazing costs have been reduced as much as 70 per cent, and production increased up to 100 per cent. Also, more uniform results, compared with hand-torch brazing, have greatly reduced the number of scrap parts that are produced.



**Fig. 8. Two-station, 15-K.W. induction heating unit for brazing, assembling, and annealing various aircraft component parts.**

### Radioactive Agent Employed as Safety Device

The McDonnell Aircraft Corporation, St. Louis, Mo., uses radioactive materials to insure the removal of all rivet bucking bars and other small tools from aircraft and component sub-assemblies prior to flight. A small radioactive source is imbedded in the body of each tool so that it can be located in the aircraft during pre-flight inspection and the tool removed.

These tools are absolutely safe. Each activated tool is inspected to insure that the proper amount of shielding is provided for maximum protection of the employees and yet permits enough radioactivity so that scintillation counters can detect misplaced tools. Cesium 137, a radioactive agent, is used to activate the tools. This agent is available in convenient form to facilitate installation and at reasonable cost.

### Honeycomb Materials Reduce Weight of Jet Engines

The General Electric Co.'s Aircraft Gas Turbine Division, Cincinnati, Ohio, is building a \$150,000 brazing facility for fabricating lightweight jet-engine structures. The new facility will produce "honeycomb sandwich" material for jet-engine structures. This material is a good insulator, can withstand temperatures of 1800 to 1900 degrees F., and is almost 80 per cent lighter than solid structural members.

The honeycomb material has been used for turbine and compressor casings, tailpipes, and reheat nozzles during experimental tests, and these components have operated very successfully. Brazed at high temperatures, the honeycomb sandwich is composed of stainless-steel or other type of high-temperature alloy skins, 0.010 inch thick, with a honeycomb core 1/4 inch thick.

# Fortieth Annual Meeting of Gear Manufacturers

**I**MPORTANT technical papers were a feature of the Fortieth Annual Meeting of the American Gear Manufacturers Association held at The Homestead, Hot Springs, Va., from June 3 to 6, inclusive. Three papers were the basis of a symposium sponsored by the Gear Rating Coordinating Committee of which E. J. Wellauer of the Falk Corporation, Milwaukee, Wis., is chairman. It was announced that the symposium would cover the work of the Committee in preparing a master standard or formula for the strength of gear teeth from which coordinated standards could be developed for the rating of spur, helical, bevel, and worm gears.

Mr. Wellauer presented the first paper, entitled "Introduction—Discussion of Historical Background, Geometry Factors, and Allowable Stress." The second paper was prepared by D. W. Dudley of the General Electric Co., Lynn, Mass. This paper was entitled "Modifying Factors Used in AGMA Strength Ratings for Gear Teeth." The third paper was presented by Wells Coleman of the Gleason Works, Rochester, N. Y. This paper carried the title "Method for Estimating the Fatigue Life of Bevel and Hypoid Gears."

Mr. Wellauer referred to areas that are common to all the gear standards, but specifically pointed to spur and helical gears. Mr. Dudley explained the many modifying factors which have been developed from good engineering judgment and field experiences. His comments also related specifically to spur and helical gearing.

Mr. Coleman covered all the factors as they specifically applied to bevel gears. He showed that the major formula used for spur and helical gears is easily adaptable to requirements for the strength rating of bevel gears. It was pointed out that many thousands of hours of individual and Committee time were spent in the development of the proposed formulas.

Another paper of considerable interest, "Present and Projected Air-Frame Control Gearing Requirements," was presented by R. W. Weber, assistant design group engineer of Convair Division of the General Dynamics Corporation, San Diego, Calif. This paper pointed out that gear engineering poses one of the big problems facing the aviation industry today. Gearing in aviation falls into four groups: (1) power plant and accessory drives; (2) actuators; (3) rockets and missiles; and (4) radar and instrumentation. Mr. Weber stated that potential requirements are a hint to a new gear concept. Until recently, gears have been associated with the transmission of power through rotary motion, which, of course, is a basic machine function. Today, however, gear-driven shafts provide intelligence—the means for rapid solution of mathematical problems and the control of supersonic missiles and automatic production machines. Mr. Weber's paper discussed accuracy, tooth surface, durability, lubrication, shock and vibration, corrosion, and different methods of mounting gears.

At a meeting of the Industrial Problems Divi-



Officers of the American Gear Manufacturers Association elected at the recent Fortieth Annual Meeting (from left to right): Gunnar E. Gunderson, president, LeRoy R. Brooks, vice-president, and Thomas A. Jones, treasurer.

sion, a paper "Authority Delegation in Medium-Sized Owner-Managed Business" was presented by Robert S. Hall of McKinsey & Co.

Gunnar E. Gunderson, president of the Brad Foote Gear Works, Inc., Cicero, Ill., was elected president of the AGMA for the coming year. LeRoy R. Brooks, president of the Tool Steel Gear & Pinion Co., Cincinnati, Ohio, was elected vice-president of the Association. Thomas A. Jones, general manager of the Jones Machine

Division, Hewitt-Robins, Inc., Chicago, Ill., was elected treasurer.

Mr. John H. Flagg, president of the Watson-Flagg Machine Co., Inc., Paterson, New Jersey, received the Edward P. Connell Award at the annual dinner. The citation stated that the award had been given to Mr. Flagg for his leadership in promoting the standards and practices of the gear industry and for his many contributions to the art of gearing.

## Bullard Opens New Foundry

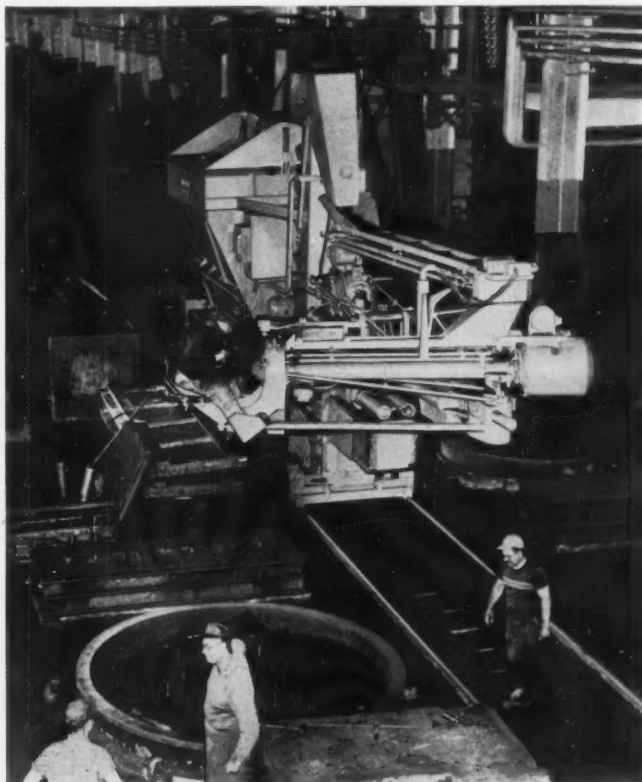
**T**O BETTER serve industry and keep pace with customers' needs, the Bullard Co., Bridgeport, Conn., has begun operation in a new \$7,000,000 foundry. Equipment of the latest design has been included to permit the production of high-quality gray-iron castings for the company's machine tools.

The size of castings that can be produced is limited only by the capacity of the overhead cranes, which is, at present, 50 tons. However, the building is constructed to take 75-ton cranes when they become necessary. The increased ca-

capacity of this new foundry makes it possible for the Bullard Co. to accept inquiries from other industries for the supply of gray-iron castings.

In planning the foundry, a system for continuous flow production was developed. A transfer car carries a loaded charging bucket to a pre-selected cupola. Here, the bucket is extended into the cupola on cantilever arms and the charge is dropped. Gas-fired movable forehearth permit continuous pouring from the cupolas and can store the molten iron in between the filling of the pouring ladles.

Hand filling and ramming of molds for gray-iron casting are eliminated with this power-operated, portable slinger which is capable of filling molds with sand at the rate of 1 ton per minute.



Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

## Combination Boring and Reaming Tool

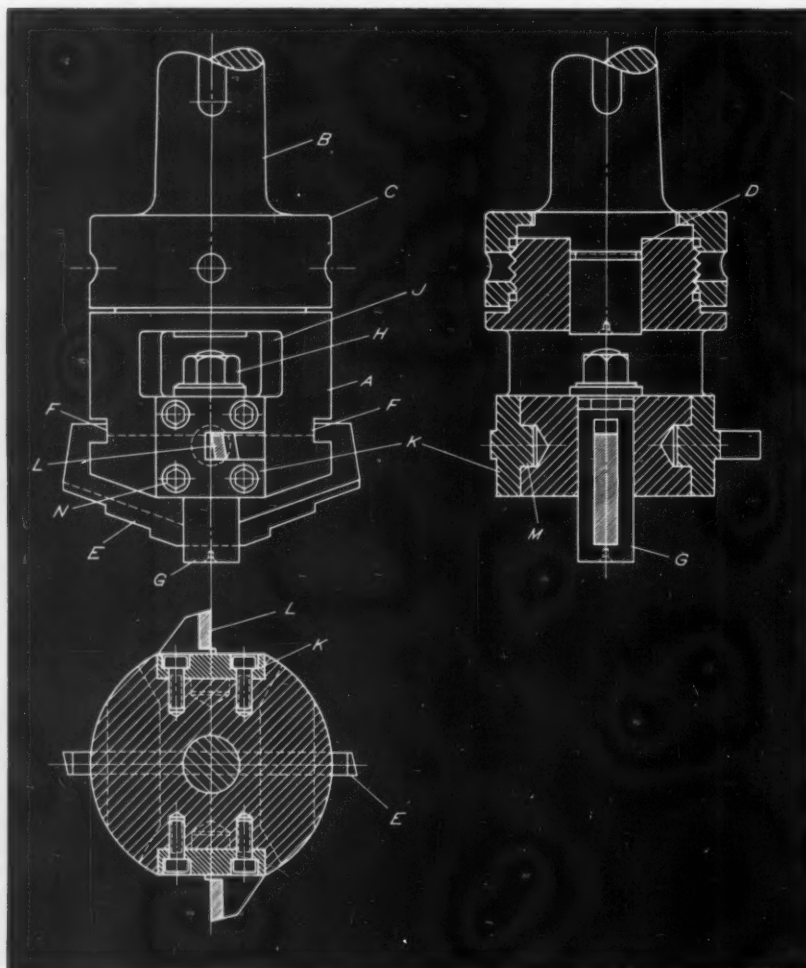
By A. G. AMOS, Calcutta, India

Drilled or cored holes can be bored and reamed in a single operation with the combination tool shown in accompanying illustration. The cutting elements are removable so that the tool can be adapted for operating in a wide size range.

Body A is joined to tapered shank B by ring-nut C. Tang D on the front of the shank transmits a positive drive through its fit in a slot in the body. For boring, spade type stepped cutter E is retained in a diagonal slot in the end of the body.

Shoulders F centralize the cutter with the body, and threaded yoke G encloses the end of the cutter and secures it in position through engagement with nut H. Milled area J is made large enough to accommodate a wrench for the nut.

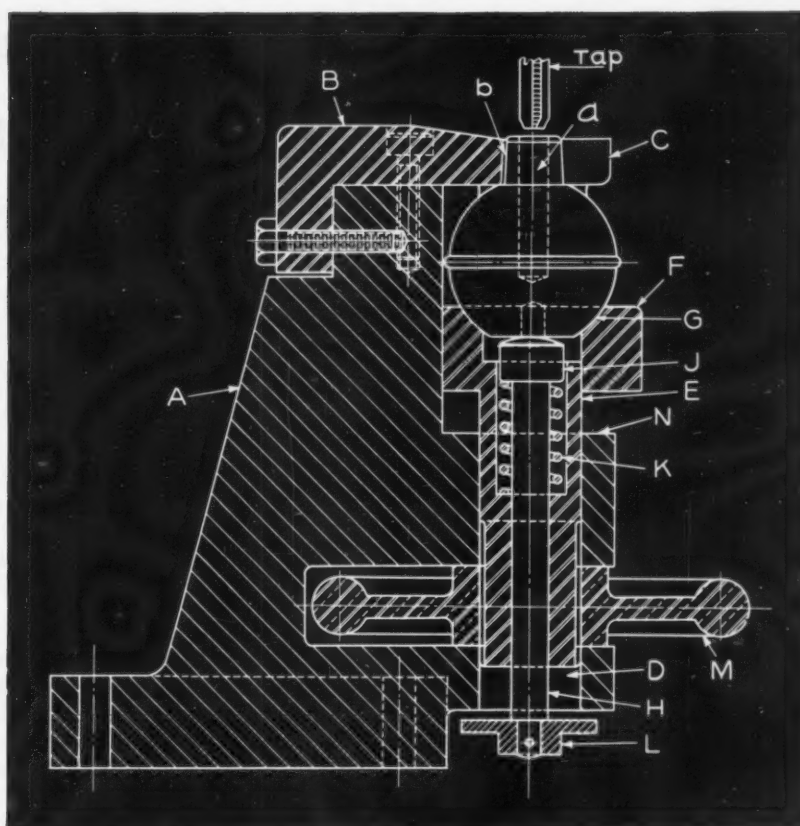
One or two holders K, having carbide cutter tips L, can be set in the body for reaming. The holders are aligned in the body by pin M and are secured by set-screws N.



Spade type stepped cutter (E) and single-point cutters (L) bore and ream at the same time.



Fixture locates a spherical die-casting and clamps it in place for performing a tapping operation.



## Tapping Fixture for Holding Spherical Parts

By W. M. HALLIDAY, Southport, England

Spherical parts frequently present a problem when means must be provided to hold them securely in machining operations. The illustration shows a tapping fixture designed to locate and clamp a smooth die-casting of spherical shape. Locating and clamping are quickly accomplished with a few turns of a handwheel. The fixture is used to tap blind hole *a* through boss *b* at the rate of about 300 pieces per hour.

Moving parts of the fixture are supported by a cast-iron column *A* and an L-shaped bracket *B* which is secured to the top of the column by screws. Bracket *B* has an open-end slot *C* to receive a boss on the upper end of a work-piece. The length of slot *C* is carefully determined so that the boss will bear against the inner closed end of the slot when the raised bead around the casting touches a vertical surface on the column.

Sliding freely within a bearing hole *D*, bored perpendicular to the base of the fixture, is shank *E* of a locating and clamping member *F*. The clamping member is restrained from turning by a machined flat that is flush against the adjacent

vertical side of the column. To provide a seat for the work-piece, recess *G* is ground in member *F*.

Locating rod *H* has a rounded head *J* for contacting the bottom of the die-casting. The rod is a free fit in a bored hole in member *F*. Upward pressure is exerted on the rod by a light coil spring *K* housed in a counterbore of the shank. The upward movement of the rod is restricted by stop-plate *L* secured by a cross-pin to the lower end of the rod. Shank *E* is threaded to screw into the bore of handwheel *M*.

In operation, the handwheel is turned to lower the locating and clamping member *F* until its bottom surface meets face *N*. Then, the boss of the die-casting is slipped within slot *C*, while its base is snapped over the head of the rod. The pressure of spring *K* holds the casting in position while the clamping part *F* is raised.

When the handwheel is turned in the opposite direction, spherical recess *G* locates the work-piece properly, at the same time pressing the shoulder of the part against the bottom surface of bracket *B*.

# Improvements in Hydraulics Promoted by Forum

**M**ORE than 200 representatives of machine tool and hydraulic equipment manufacturers and users attended the Second Production Machine Tool Hydraulic Forum held recently at the Engineering Society of Detroit Rackham Memorial Building, Detroit, Mich. The highly successful meeting was sponsored by Vickers Incorporated for the purpose of promoting discussions that will lead to improvements in hydraulic products, system designs, and maintenance methods.

Louis Polk, president of the Sheffield Corporation and the National Machine Tool Builders' Association, delivered the keynote address on "Infinity in Action." He cited the interdependence in progress between hydraulics, machine tools, and metrology. As an example, Mr. Polk described one of the first projects of the new Sheffield Eli Whitney Metrology Laboratory involving the machining and measurement of a piston and cylinder assembly to retain a liquid pressure of 60,000 pounds per square inch. The seal is dependent solely on the cylindrical fit, and the slippage rate is less than 1/2 cubic inch per month. Mr. Polk emphasized that continuing progress will depend on our ability to divide the inch finer and finer. Nevin L. Bean, technical assistant to the general manager, Automatic Transmission Division, Ford Motor Co., was guest speaker at the dinner meeting. Mr. Bean reported on his recent visit to industrial plants in the U.S.S.R.

A progress report on developments since the First Production Machine Tool Hydraulic Forum, held in 1954, was presented by J. Robinson, chief engineer of industrial products, Vickers Incorporated.

It was admitted that external leakage is still a major problem in the application of hydraulic equipment. However, it has been found that improved results are being obtained by gasket mounting larger valves with more bolts, having shorter distances between centers. Also, a patented non-drying paste having about 70 per cent lead in suspension has been found successful for sealing plug threads. Use of new SAE standard seals, adherence to J.I.C. standards, and the adoption of mismatched taper pipe threads were other suggestions offered. Mention was also made of Vickers' successful hydrogen brazing of cast-iron core plates to steel outer plates for laminated design manifolds.

Hans Ernst, director of research at the Cincinnati Milling Machine Co., represented the machine tool builders, and Russell L. Dustman, productive equipment manager, Chevrolet Division, General Motors Corporation, represented the machine tool users as the able moderators during the Forum.

## *Hydraulic Circuit Problems*

In that portion of the agenda devoted to hydraulic circuit problems, considerable discussion was directed toward the common complaint of chatter in broaching. It was pointed out that chatter is encountered in electrical and mechanical drive broaches, as well as hydraulic machines, and is generally the result of improper tool design for the interrupted cut loads encountered or insufficient support or clamping of the work. Means suggested for eliminating chatter included



Moderators for the Vickers-sponsored Second Production Machine Tool Forum: (left) R. L. Dustman, productive equipment manager, Chevrolet Division, General Motors Corporation; and (right) H. Ernst, director of research, the Cincinnati Milling Machine Co.

having more teeth cutting at one time, applying proper back pressure, increasing the power of the machine, using a rubber bladder accumulator, or employing two cylinders of different diameters.

Representatives of machine tool users expressed an overwhelming preference for a separate hydraulic power unit for each head on a transfer machine, rather than the operation of several heads from a single pump. Machine tool manufacturer representatives agreed that it was practical to make hydraulic manifolds from aluminum to facilitate drilling long holes and to reduce the weight. However, care must be exercised because of the different coefficient of expansion of the material.

In considering the cylinder system preferable for a reciprocating cycle, it was brought out that several machine tool manufacturers use both the 2 to 1 differential, single-end piston type and the 1 to 1 double-end piston type. It was agreed that the former system requires less space, but speed regulation is poor at low speeds. The double-end piston type can be used with exhaust control and has good regulation at low speeds.

#### *Fittings, Tubing, and Valves*

It was the consensus of opinion that more attention should be given to drain lines. One participant recommended using a vented manifold. Another stated that his company specified one size larger pipe for all return lines. Considerable discussion resulted from the agenda item asking

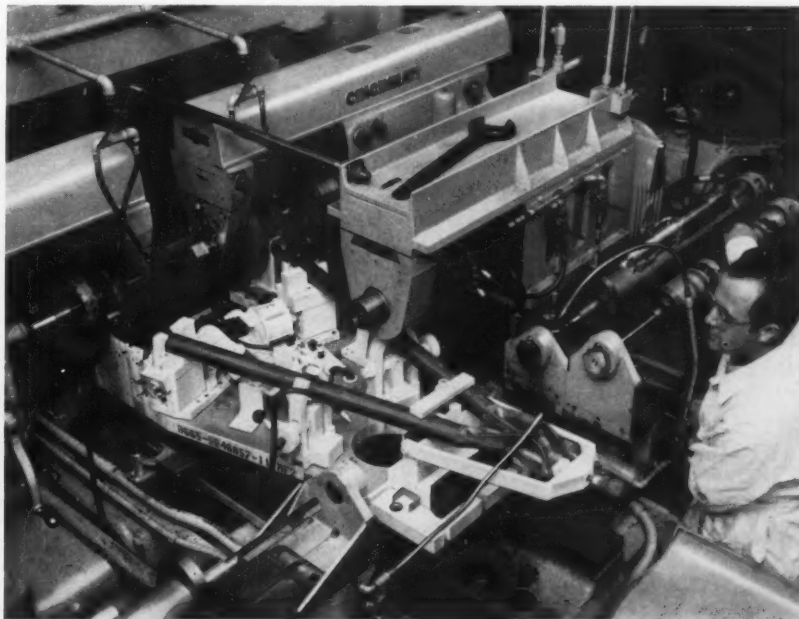
whether it was more desirable to place tubing and hydraulic equipment on the outside of the machine or to conceal them inside the base. Users agreed that outside mounting was preferred for ease of maintenance and better cooling. However, representatives of machine tool manufacturers pointed out that the improved appearance with inside mounting does influence sales. One compromise suggested was to mount the tubing in a trough under the work, thus improving appearance without affecting maintenance. Also, the coolant would help dissipate the heat generated.

#### *Fluid Motors, Filters, and Maintenance*

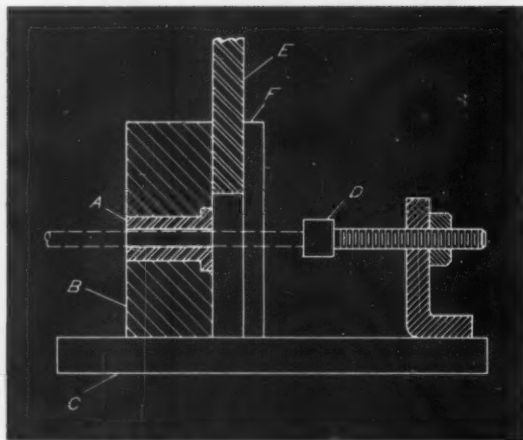
A Vickers engineer explained that gear, vane, and piston type motors are all being used for braking action in different applications. However, vane type motors should be limited to pressures of 1000 pounds per square inch, while the other two types can be used for higher pressures. All three motors can have their speed regulated with metered out flow control.

In discussing filters, it was pointed out that continuous filtration is much preferred to periodic cleaning because it is automatic, cheaper, more effective, and requires less down time. Calibrated pressure gages are employed by some users to indicate when the filter cartridge should be changed. Another user commented that magnetic plugs are proving successful in removing particles from the hydraulic fluids. However, proper installation and the use of a baffle are essential.

An arresting hook is drilled and straddle-milled in one set-up at the Torrance, Calif., plant of Douglas Aircraft's El Segundo Division. To the basic machine tool—a Cincinnati duplex milling machine—were added a Romulus head and three Keller air drills. In initial position, table is at extreme right for drilling. One gun drill machines a hole through a clevis on one leg of the hook, and two opposed gun drills machine holes in the ends of both legs. Then the table feeds to the left. The Romulus head straddle-mills the clevis, and the two heads of the Cincinnati machine straddle-mill the leg ends. Drill tips and milling cutters are of carbide.



# Ideas for Shop and Drafting-Room



Shear type die that enables mass production of pins having various lengths

## Simple Die Cuts Pins to Various Lengths

By FEDERICO STRASSER, Santiago, Chile

When it is necessary to produce a great many pins having the same diameter but different lengths, an easily constructed die mounted in a light automatic press has proved effective. The assembly of the die and its components is shown in the accompanying illustration. A hardened bushing *A* is pressed into body *B* which is mounted on base *C*. The face of the bushing head is ground to provide a cutting edge. The wire is fed by hand through the bushing against stop *D*,

which is a cap-screw engaged with a lock-nut to vary the length of the pin. The cutting action of the die is supplied by a shear blade *E* which is guided by plate *F*. In operation, the no-repeat device on the press may be removed to increase production.

## Sight Gage for Radially Ground Cutters

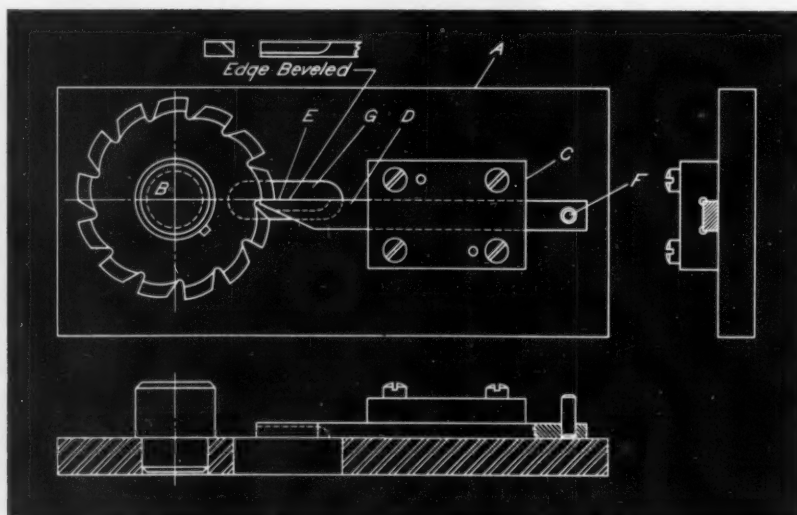
By H. J. GERBER, Stillwater, Okla.

For a radially ground form milling cutter to reproduce its exact profile, all tooth faces must be normal to the center line of the cutter. To inspect this condition, the simple gage illustrated may prove effective.

The gage consists of a steel or aluminum block *A*, with a stub-arbor *B* for the cutter and a bar bracket *C*. A bar *D* is a sliding fit in a channel in bracket *C*. This bar is ground to a knife edge *E* that is on the arbor center line. To advance and retract the bar, a pin handle *F* is provided. An open slot *G*, milled through the block, serves as an inspection window.

In use, the block is supported on its lower edge so that light can be seen through the slot. After the bar is retracted, the cutter is placed on the arbor, with the teeth facing in the direction illustrated. With the bar advanced into the gullet of one of the teeth, the cutter is rotated until the adjacent tooth face bears on the knife edge of the bar. Daylight visible at either end of the line of contact indicates improper grinding.

If the teeth are radial, no daylight will be visible at either end of the line of contact of knife edge (*E*).







## MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

### Formula for Checking V-Shaped Grooves in Circular Form Tools

In producing blanks for precision bevel gears, it is essential that the crown point of the blank be accurate both as to axial location and diameter. It follows, then, that the diameter at the bottom of the vee in the circular form tool used to machine the blank must also be accurate.

One way in which the diameter at the bottom of the vee in the tool can be checked is by measuring over two pins placed opposite each other in the V-groove. How is the formula for the measurement  $x$  over the pins obtained if the radius  $r$  of the pins and the diameter  $a$  at the bottom of the groove are known?

#### Solution:

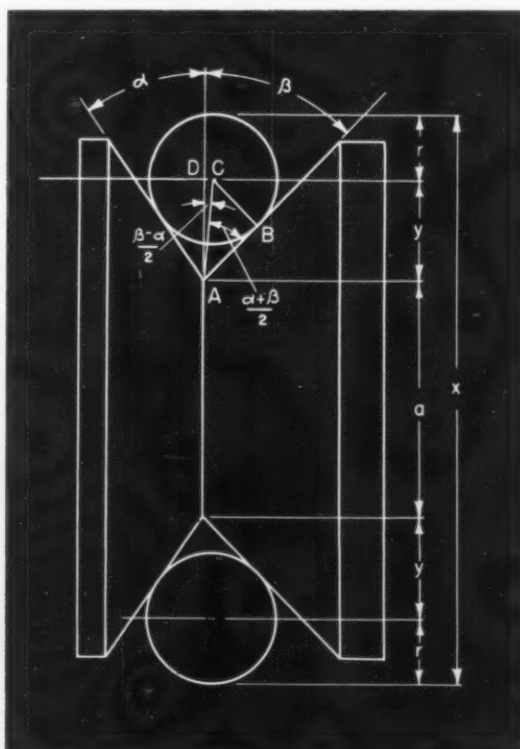
Since  $a$  and  $r$  are known, the problem is to determine  $y$ , the distance from the center lines of the measuring pins to the bottom of the groove. If  $AC$  is a line drawn from the bottom of the vee to the center of the upper pin, as shown in the diagram, and  $CB$  is a line drawn from the center of the pin to its point of tangency with the side of the vee, then a right-angled triangle is formed in which one side,  $CB$ , is known and one angle,  $CAB$ , can be determined.

A line drawn from the center of a circle to the point of intersection of two tangents to the circle bisects the angle between the tangents. Hence, angle  $CAB = (\alpha + \beta) \div 2$ . Therefore,  $AC$  can be found. Angle  $DAC$  can now be found and with  $AC$  known in right-angled triangle  $ADC$ ,  $AD$ , which is equal to  $y$ , can be found. The following steps show how the formula for the measurement  $x$  over pins is obtained.

1. Angle  $CAB = \frac{\alpha + \beta}{2}$
2.  $AC = CB \div \sin \frac{\alpha + \beta}{2}$
3. Angle  $DAC = \beta - \frac{\alpha + \beta}{2} = \frac{\beta - \alpha}{2}$

4.  $AD = AC \times \cos \frac{\beta - \alpha}{2}$ , and by substituting the value of  $AC$  from Step 2,

$$AD = \frac{CB \times \cos \frac{\beta - \alpha}{2}}{\sin \frac{\alpha + \beta}{2}}$$



The measurement ( $x$ ) over two pins placed in a V-groove can be determined by Formula 6 when diameter ( $a$ ), angles  $\alpha$  and  $\beta$ , and the radius ( $r$ ) of the pins are known.

5. Since  $AD = y$  and  $CB = r$ , these values can be substituted in Step 4 to obtain  $y$ :

$$y = \frac{r \times \cos \frac{\beta - \alpha}{2}}{\sin \frac{\alpha + \beta}{2}}$$

6.  $x = a + 2r + 2y$

$$= a + 2r + 2 \times \left[ \frac{r \times \cos \frac{\beta - \alpha}{2}}{\sin \frac{\alpha + \beta}{2}} \right]$$

$$= a + 2r \times \left[ \frac{\cos \frac{\beta - \alpha}{2}}{\sin \frac{\alpha + \beta}{2}} + 1 \right]$$

**Example:**

If the form tool angles are  $\alpha = 35^\circ$  and  $\beta = 45^\circ$  and the diameter of the bottom of the groove is to be 1.824 inches, what is  $x$ , the measurement over pins, if the pins are 1 inch in diameter ( $r = 0.500$  inch)?

From Step 6,

$$x = 1.824 + 2 \times 0.500 \times \left[ \frac{\cos \frac{45^\circ - 35^\circ}{2}}{\sin \frac{35^\circ + 45^\circ}{2}} + 1 \right]$$

$$= 1.824 + \left[ \frac{\cos 5^\circ}{\sin 40^\circ} + 1 \right]$$

$$= 1.824 + \left[ \frac{0.99619}{0.64279} + 1 \right]$$

$$= 1.824 + [1.5498 + 1]$$

$$= 4.3738 \text{ inches}$$

## Nylon Solves Tube-Bending Problems

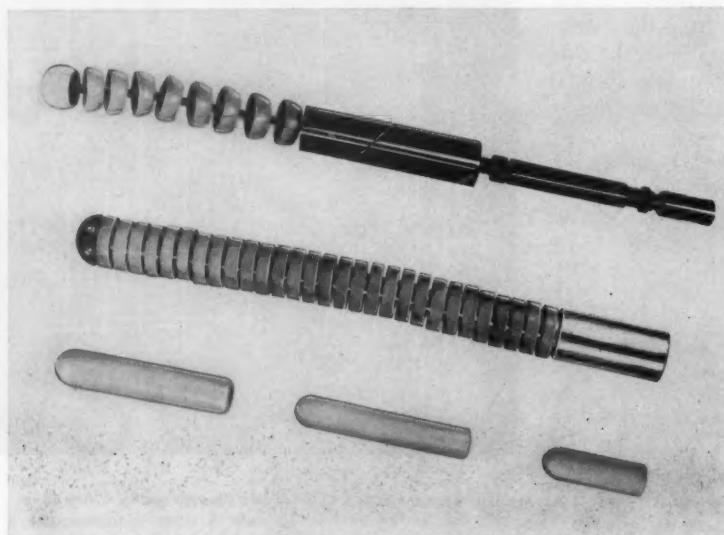
Nylon tube-bending mandrels, engineered by Douglas Aircraft Co., Inc., Santa Monica, Calif., have been reported to provide considerable savings of money and assembly time. The nylon parts for the mandrels were machined from Polypenco rod stock supplied by the Polymer Corporation of Pennsylvania, Reading, Pa.

For heavy wall or smaller diameter tubes, a bullet type mandrel, such as seen at the bottom in the accompanying illustration, is inserted to a spot just below the point of bend. The mandrel remains stationary as the tube is drawn. Flexible segmented type mandrels (center) are used for bending thinner wall or larger diameter tubing, which is more collapsible. More frequently used than the bullet type, such mandrels are inserted in the tube and travel with it around the forming shoe.

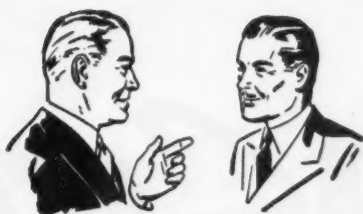
A segmented ball mandrel of 1 inch diameter, fabricated from nylon, is reported to cost only one-third that of the original polished steel. In addition, the nylon mandrel was cut, formed, and assembled by Douglas in five hours, whereas the original steel mandrel required seven days for delivery.

The abrasion resistance of the nylon permits long wear. At the same time, its resiliency allows the mandrel to deform slightly, distributing the load during the bending cycles and reducing chattering and vibration. Nylon's low surface friction eases the insertion and removal of the mandrel and minimizes the drag during the drawing operation. Also, the high tensile strength prevents tearing of the mandrel during the bending operation.

The segmented mandrel can be made up of a number of discs or ball-shaped segments with a center hole. A flexible steel cable is threaded through these segments to form the complete mandrel. Machining of the segments is conveniently carried out on standard metal-working equipment.



Bullet type mandrels (bottom), flexible segmented mandrel (center), and flexible ball mandrel (top), made from nylon stock



# Talking With Sales Managers

By **BERNARD LESTER**  
Management Consulting Engineer

## Thanks for Customer Criticism!

**T**HE superintendent stopped on a tour through his plant, and, pointing to a machine tool, commented "I was just bristling with sales resistance before I specified that. I never offered so many objections, or saw a sales engineer meet so many raps, one after another. The machine has been in the shop six months now, and soon we can forget about its cost!"

Prospects erect bulwarks against sales. Customers criticize and complain. Though their repeated objections are aggravating, don't we owe them a lot for objecting? They point a way to improvement in equipment and company service. They help make salespeople more alert, more resourceful, and more persistently tactful. Withholding, or even sugar-coating, criticism is a disservice to any sales engineer.

One problem that confronts every sales manager is how to apply the prospect's objections and criticisms toward improving sales performance. A conventional way to do this is to make use of the lost-business report. Too often this is a clerical chore, hurriedly prepared at the expense of selling time to meet a company date line.

Since the lost-business report is an "after-the-fact" record, it soon enters the category of sales statistics. Many manufacturers still classify and record each report as an order lost on "price," "delivery," or "unsuitable equipment," and so on, as though the loss of an order is due to only one of these or similar causes, none of which is "ineffectual salesmanship." Thus, many of us have relegated the analytical study of market criticism and objection to a system of communication and record which is about as inspiring as a pile of dry bones.

Repeated autopsies may well reveal causes of death. But they cannot equal in importance a careful diagnosis which makes prevention possible.

Just one example. A sales manager is alarmed by the large volume of business lost on price. This brings about an analytical study to reduce costs. Quite desirable! Next comes a huddle of company officials to discuss the advisability of a price re-

duction. But the following very important question is often overlooked. "What steps can be taken by our sales engineers and promotional people to meet the prospect's objections to high price and make value outweigh cost?"

Perhaps what one equipment sales manager does to put customer criticism to work may stimulate thought and sound planning. His plan for turning prospect criticism into salesmanship appears quite ordinary. Yet it works surprisingly well because it is persistently followed with a determination to improve selling methods.

1. Each sales engineer sends in a brief report when he opens up a new equipment negotiation. The reports are arranged according to industry, estimated size of equipment, new or old application, and new or old customer. Each report of significance must pin-point anticipated prospect objections and criticisms.

2. Each sales engineer sends in a brief report on jobs lost, first, naming the prospect's objections and, second, a frank statement of what might have been done to overcome them. The tabulation of these reports contributes to a study of the market and marketing trends and changes.

3. Each month some important lost order is selected for the purpose of a penetrating study. Preferably the salesman involved is present at headquarters. This analysis of a lost job is far from an "inquisition" or "court trial" of the sales engineer. It is regarded as a constructive study that serves as an opportunity to present definite plans for sales improvement.

Don't stifle prospect or customer criticism. Invitation of criticism often has a wonderful psychological effect on the buyer. Expression of criticism by the buyer must be taken seriously. There must be a clear-sighted response by the supplier, so that the criticism can lead to mutual understanding and confidence.

Some of the best designs in modern equipment are based to a large extent on customer suggestion. It follows that customer suggestion can also lead to better selling methods. Lend a sensitive ear to the complaints of intelligent buyers.

## LATEST DEVELOPMENTS IN

# Shop

### Red Ring Rotary Gear-Shaving Machine for Crown-Shaving Extra Large Gears

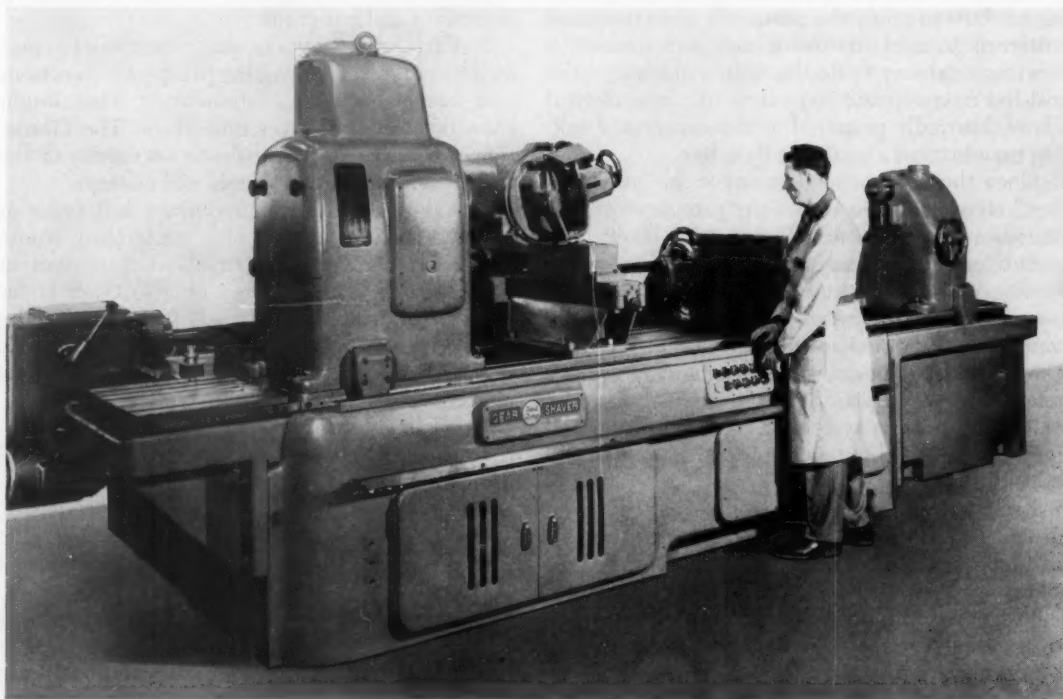
A huge, Red Ring rotary gear-shaving machine with a capacity for crown-shaving external gears having pitch diameters up to 48 inches and distance between centers up to 62 inches is available from the National Broach & Machine Co., Detroit, Mich. Spur and helical gears up to 12 inches wide and with an outside diameter of 52 inches in the 2 to 16 diametral pitch range can be crown-shaved on this Model GCJ-48-inch machine. Shaving without

crowning can also be done on spur and helical gears up to 36 inches wide and 142 inches between centers in the same tooth-size range. Previously the largest gear that could be crown-shaved measured 36 inches between centers and was handled on the Model GCJ-36-inch Red Ring machine.

Crown-shaving is accomplished by rocking-table action—in which the table that supports the headstock and tailstock is rocked

around a center pivot while the gear is power-driven in mesh with a reciprocating gashed rotary gear-shaving cutter. With this shaving method, the elliptoid tooth form is produced on the gear teeth. This form has slightly thinner tooth sections at the ends of the teeth than in the middle portion and thus avoids the detrimental operating effects of tooth end bearing or shaft misalignment.

The Model GCJ-48-inch rotary



Giant-size Red Ring gear-shaving machine equipped for crown-shaving large gears



# Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

gear-shaving machine has a one-piece cast-iron base. The cutter-head is mounted on a saddle at the rear of the machine. The work drives the cutter which is meshed with the work-gear in crossed axes relationship during the shaving process. Either manual or automatic means can be used to feed the cutter into the work in selected increments from 0.001 to 0.003 inch at the end of each stroke of the cutter. Cutters 7, 9, and 12 inches in diameter are used.

The direction of work rotation is reversed at each end of every stroke to assure uniform shaving of both sides of the teeth. Axial travel of the saddle is controlled by a clutch-equipped transmission that provides both feed and

traverse speeds. Separate motor drives are provided for headstock rotation, cutter reciprocation, and coolant pump operation. Push-buttons control all machine functions. The machine occupies a floor space about 113 by 114 inches and has an over-all height

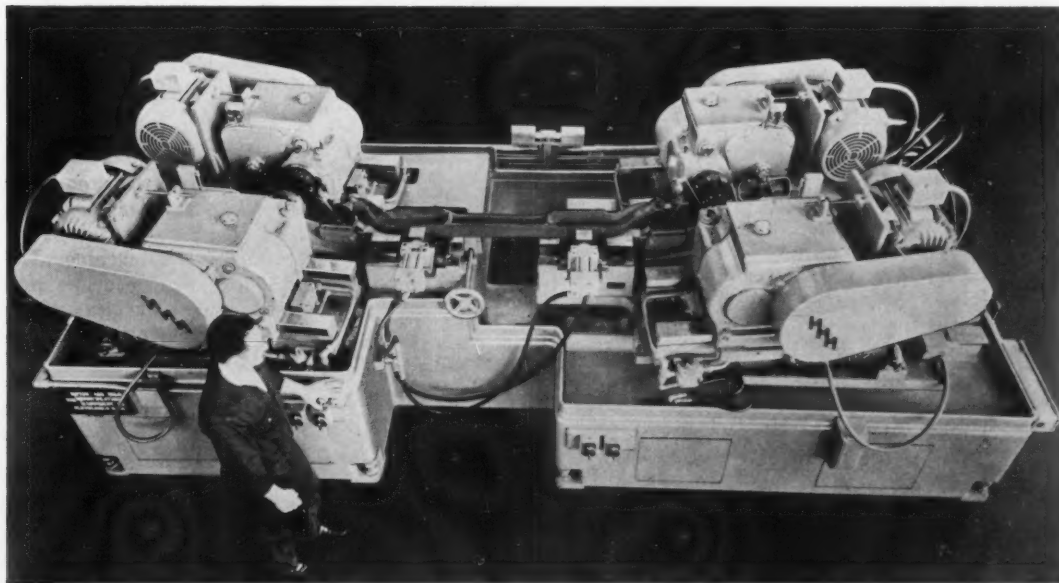
of 82 inches. It weighs 44,500 pounds and is equipped with a 5-H.P. motor that drives the headstock, and a 3-H.P. motor that furnishes power for transmitting the reciprocating movement to the cutter.

Circle Item 101 on postcard, page 261

## Motch & Merryweather Double Duplex Milling Machine

A double duplex milling machine brought out by the Machinery Manufacturing Division, Motch & Merryweather Co., Cleveland, Ohio, has two pairs of opposed milling heads that operate simultaneously from four sides to mill the kingpin bosses of forged steel axles. Two surfaces on each end of a front axle are face-milled in correct relationship

to the frame-mounting surfaces. The machine has two tables on each side of the base. These tables are adjustable and can be set to mill the surfaces of the part to various angles. On each table are mounted opposed (right- and left-hand) milling heads, each on broad hardened ways. The right-hand table is mounted on ways, in order to adjust the distance



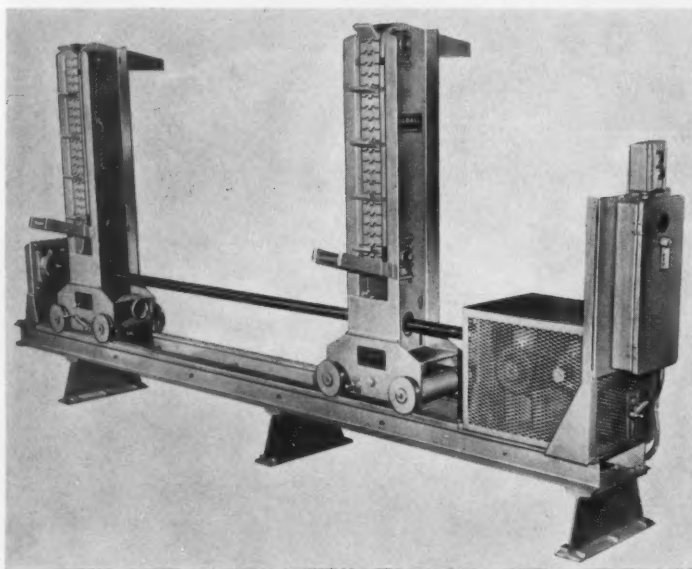
Motch & Merryweather double duplex milling machine for milling axle kingpin bosses

between the pairs of milling heads. Each milling quill has a 2-inch adjustment so that it can be set to obtain accurate spacing between the milling cutters. The universal type fixture serves to equalize endwise positioning and to provide for variations in part design and size.

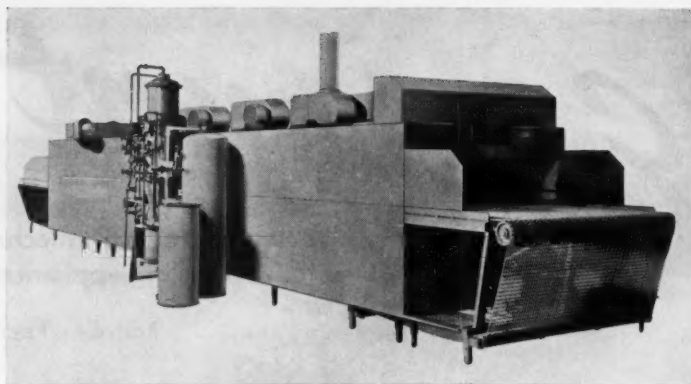
The part is loaded by a hoist into the fixture, and the operator mechanically equalizes its endwise position. Hydraulic clamping is obtained by pressing the cycle button. The cycle consists of rapid traversing the four milling heads to their milling positions, feeding of the four heads simultaneously across the surfaces to be milled, stopping and rapid traversing return to the starting position, and unclamping the fixture.

All machine movements are automatic, except for loading and unloading the part. The control and actuation are by hydraulic power. The milling heads are of the universal type, heavy-duty, single-speed, with provision for speed changes obtained by change gears. Although this machine is built to process a specific part, it can be adapted for handling similar parts by varying the positions of the universal components which hold and machine the work.

Circle Item 102 on postcard, page 261



Bar stock unloading machine brought out by Feedall, Inc.



Machine for washing metal parts built by Stoelting Brothers Co.

### Stoelting Automatic Washing Machine

An automatic water washer for spotless cleaning of metal parts or products, which operates virtually unattended, has been developed by Stoelting Brothers Co., Kiel, Wis. This machine leaves no residual matter or watermarks on the washed metal parts, thorough cleaning being accomplished by a series of washing stages which includes rinsing with de-ionized water.

The washer is so arranged that all water washing solutions and rinsing water can be re-used. It provides a continuous flow of work through the cleaning stages, pre-

paring products for finishing operations or immediate packaging. Each washer is built to meet the space requirements of the individual purchaser. Cleaning operations can be modified or changed to suit specific requirements.

Circle Item 103 on postcard, page 261

### Feedall Bar Stock Unloader

Feedall, Inc., Willoughby, Ohio, has brought out a machine that unloads pieces of bar stock or tubing from a production machine and transfers them to a high tote box. This unloader has one stationary tower and one movable elevator so that it can be adjusted to handle pieces from 3 feet to 12 feet in length and from 1 1/2 to 3 inches in diameter at a variable rate of elevating speed.

Operation of the unloader is comparatively simple. The bar or tubing flows from the production machine into a V-shaped trough which is tipped to one side as the piece leaves the machine. The piece slides down an incline until it is picked up by the cleats of the two elevating conveyors which operate in unison. It is lifted to the top of the conveyors and carried over to the other side of the uprights where it rolls into the tote box.

Power is furnished by a 1/2-H.P., 220- or 440-volt, 3-phase motor operating through a square shaft which motivates both elevating conveyors.

Circle Item 104 on postcard, page 261

### "Metal Monitor" for Checking Metals

A portable electronic instrument called the "Metal Monitor," designed for checking metals without making a laboratory analysis, has been announced by the Brush Electronics Co., Division of Clevite Corporation, Cleveland, Ohio. This instrument identifies ferrous and non-ferrous metals by comparative testing with known samples and can be used to sort mixed metals of unknown character into homogeneous groups for further testing. It can also be employed to check stock, parts in process, or finished products for many characteristics other than chemical composition, such as hardness, heat-treatment, metallurgical structure, uniformity, plating thickness, and plating adhesion. The instrument will detect a difference in composition between two pieces of steel of as little as one point in the carbon content.

Operation of the device requires no special or technical education. It is portable (21 pounds) and can



"Metal Monitor" being used to check parts for proper heat-treatment

be moved to the job. Since the "Metal Monitor" is non-destructive, it can be used on finished parts and assemblies. Only a very small area of the piece is contacted in making a test. As many as 3000 pieces per hour can be checked.

Circle Item 105 on postcard, page 261

### Compact Transfer Machine for Processing Camshafts

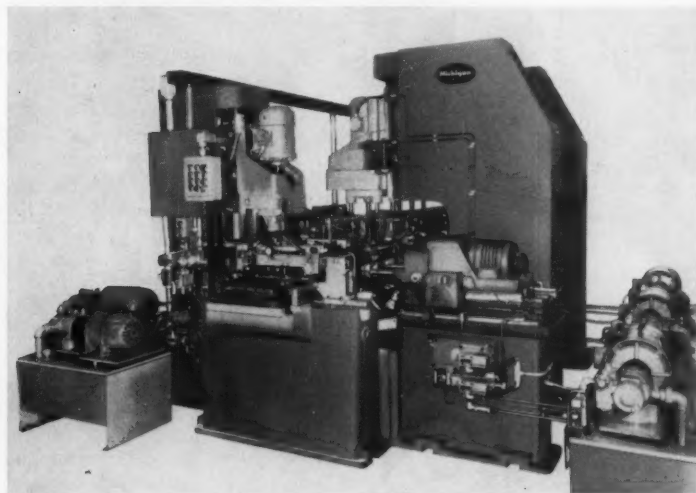
Production and handling of camshaft are being facilitated by a special transfer machine designed and built by the Michigan

Drill Head Co., Detroit, Mich. The machine has twelve stations built around standard components. These components, as well

as the transfer, locating, and clamping mechanisms, are hydraulically operated and electrically controlled.

The bearings and journal of the camshaft have at this stage been rough-turned, the ends faced and centered, and the sides of the front bearing have been faced. As the part progresses through the machine, it rides on the two end bearings and is guided on both sides of the front bearing. It is pushed by two fingers that bear on the camshaft between the lobes and fed into the machine from a hopper by an automatic loading device. When the part is placed in position on the machine, it operates limit switches which start the transfer cycle. As the camshaft is being transferred, various rails control its position by interfering with the cam lobes in such a manner as to prevent rolling.

At the eleventh station, rubber pads cover three vertical holes drilled in the preceding station. Air is then blown through the holes. If a hole has not been drilled to depth, no air passes, causing a pressure build-up which—through a pressure switch—will stop the machine. With proper drilling, the pads back off and signal that a part has been completed. The part is unloaded onto a conveyor at the last station. Wherever a hole is to be drilled



Twelve-station transfer machine for processing camshafts built by the Michigan Drill Head Co.

and reamed, or drilled and tapped, a broken-tool detector is used to protect the work and tools. All moving parts of the machine are automatically lubricated. The cutting tools are run at a surface

speed of 60 feet per minute and fed at the rate of 5.25 inches per minute. The estimated production at 80 per cent efficiency is 151.2 pieces per hour.

Circle Item 106 on postcard, page 261

### Turchan Automatic Die-Sinker

An automatic, bed type die-sinker of solid cast-iron construction, designed to handle the heaviest cuts and maintain an exceptionally high degree of accuracy, has been brought out by the Turchan Follower Machine Co., Detroit, Mich. Equipped with a Turchan magnetic tracer, this machine can be operated in three different ways. It is primarily a fully automatic die-sinker but it can also be used as a power-operated straight milling machine or as a hand-operated straight milling machine. Any one of these three methods of operation can be selected by means of the central knob of the control panel. When set for fully automatic operation, the length of stroke can be adjusted to cover the work-piece, and the desired feed can be selected at the end of the cut.

A second tracer control can be

used for contour-machining operations. Automatic interchangeable feeds and indexes are available for ram and table. As the tracer automatically coordinates the vertical movement of the cutter with table and ram movements

to accurately reproduce the profile of the master model, electric limit switches control the adjustment of the stroke length. A precise three-way micrometer adjusting assembly assures fast and easy set-up.

The 17- by 57-inch table is heavily ribbed with extra-long guide ways that provide maximum bearing area and eliminate excessive overhang which might cause distortion and bending. Work-piece and model are mounted on a common base.

Circle Item 107 on postcard, page 261

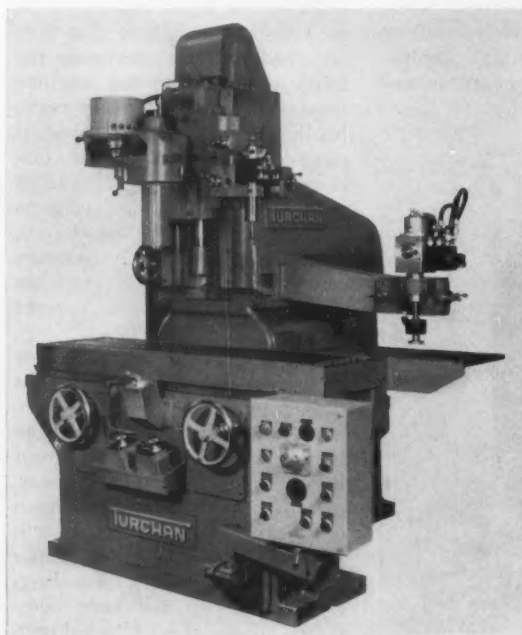
### "Clear-Flo" Lubrication System for Clearing Presses

The Clearing Machine Corporation, Chicago, Ill., has introduced a "Clear-Flo" press lubrication system that automatically supplies clean, circulating oil to every part of the press requiring lubrication. The outstanding feature of the "Clear-Flo" system is the method of metering the oil, which eliminates clogging.

This system—based on a new application of a standard engineering principle that controls the flow of oil accurately and safely—consists of inserts resembling

large and exaggerated screw threads. The oil passes spirally through the metering block and around the insert on its way to the lubrication point.

The principle is simple. More oil will pass through a short tube than a long one of the same diameter in a given period of time. This is due to friction between the oil itself and the walls of the tube (or screw in the "Clear-Flo" system). The longer the insert, the less oil will pass through it. At no point in the circuit is the oil pas-



Automatic die-sinker equipped with magnetic tracer made by Turchan Follower Machine Co.

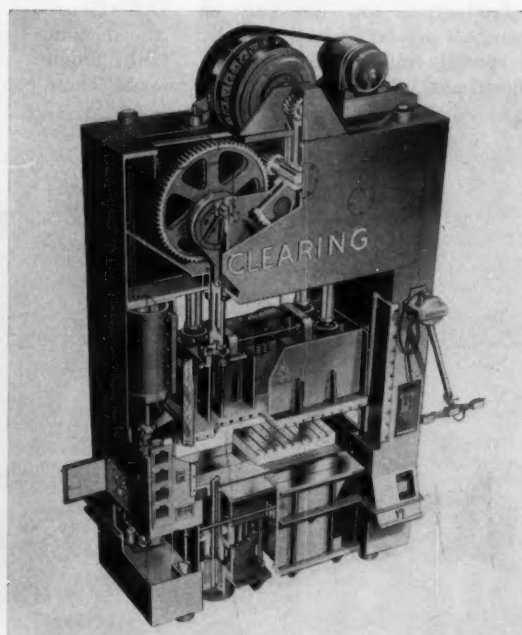
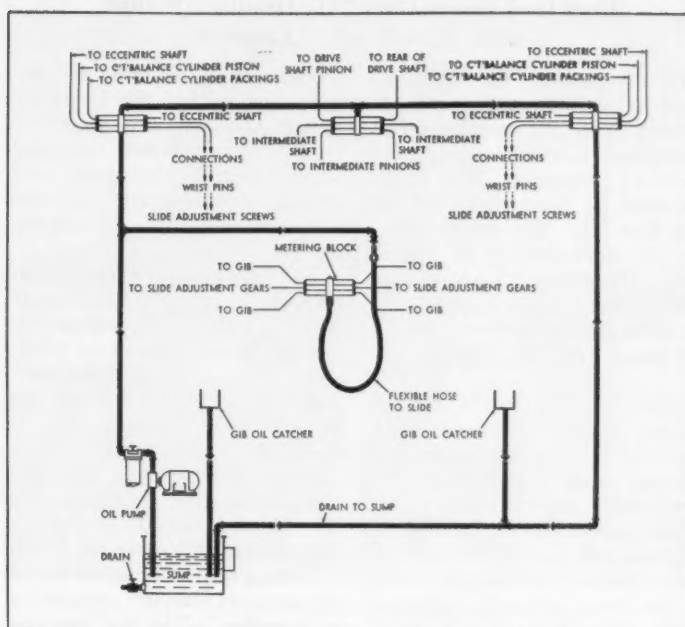


Fig. 1. Cut-away view of Clearing straight-side press showing "Clear-Flo" lubrication system





sage reduced to less than the area of a 5/32-inch tube. As a result, this system provides metering without restricting. In addition, large, clear passages are provided at the emission points. There is no danger area where clogging can take place. Any foreign material is flushed completely through the system and removed by the filter. The metering device is calculated to place the right amount of oil at each individual gear and bearing in the press.

The flow of oil through a Clearing straight-side press such as shown in Fig. 1 is from an oil sump located in either the press bed or a press upright, depending upon other design requirements. A float switch with an indicator light on the main control panel provides a visual check on the oil supply.

Oil is pumped from the sump, Fig. 2, through the filter. If the filter becomes clogged, a safety valve in the pump will return the oil to the sump. The loss in system pressure will actuate a safety switch and prevent the press from operating. The oil is pumped to several distributing blocks at the top of the press crown where it is metered and directed to various parts of the press. All shaft bear-

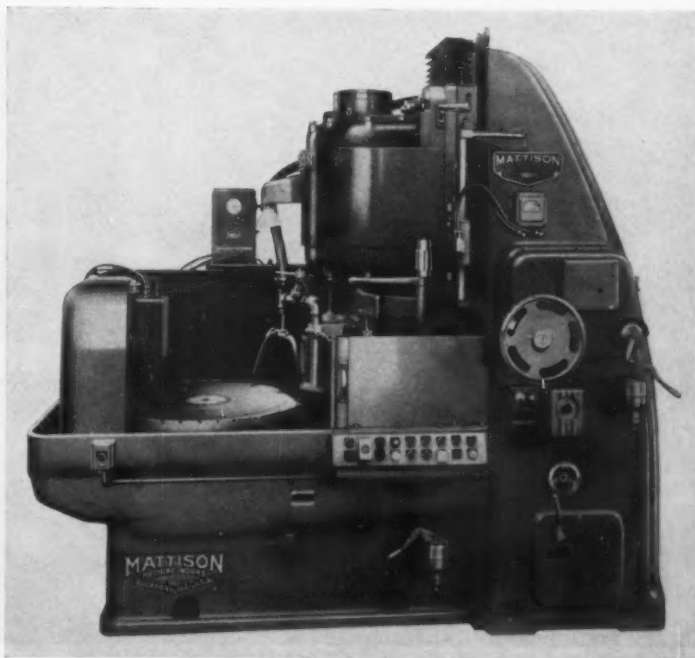
ings, meshing points of gears, and main bearings are lubricated with oil. Oil from the main bearings and gears is directed to wrist-pin and plungers, and from there to the slide adjusting mechanisms.

Circle Item 108 on postcard, page 261

## Mattison Redesigned Surface Grinder

The Mattison Machine Works, Rockford, Ill., have redesigned Models 24 and 36 vertical rotary surface grinders to increase their stock-removing capacities and to adapt them for handling close-tolerance work. Automatic cycling is available on these high-powered surface grinders through the use of one of two automatic systems that may be installed at extra cost. Either system will provide push-button-actuated automatic cycling which includes switching on the coolant pump; moving the table into grinding position; magnetizing the table and starting it rotating; feeding to size, according to the gaging system; sparking out; and returning all elements of the machine to their original positions ready to repeat the loading and grinding operations.

The air gaging system measures the work continuously and gives the operator visual indication that parts are approaching the finished size. The micro-switch automatic sizing system is an electromechanical device which measures the work continuously and actuates the auto-



### Redesigned surface grinder announced by the Mattison Machine Works

matic cycle at the completion of the grind. The machine is then ready for the next load.

A continuous down feed system increases the range of feeds. The base is made stronger and more rigid by the addition of cross-girths. The tank is now made separate from the machine so that changes in coolant temperature cannot affect machining accuracy. Two flushing nozzles in the base wash sludge into the coolant tank. A coolant separator can be used.

Two spindle-driving systems are available. One is a built-in drive with semi-enclosed motor and the other, a coupling type drive with standard, totally enclosed, fan-cooled motor which meets J.I.C. standards. A new venting method prevents coolant mist from being drawn into the motor. Standard equipment on the Model 24 is a 30-inch magnetic chuck and 18-inch segmented wheel, and on Model 36, a 36-inch magnetic chuck and 18-inch wheel. Larger size chucks and wheels are available. Both machines are designed for heavy stock removal, a 40-H.P. motor being standard on the Model 24 and a 50-H.P. motor on the Model 36.

Circle Item 109 on postcard, page 261

### Rockford Heavy-Duty "Hy-Draulic" Planer with "Elecdraulic" Control

To complement the development of carbide tools, and in keeping with the trend toward centralized machine control, the Rockford Machine Tool Co., Rockford, Ill., has brought out the H-3 drive with "Elecdraulic" control for application to its heavy-duty "Hy-Draulic" planer. This drive makes it possible to actuate all table and feed movements of the planer from its pendant control.

The drive has three distinct ranges, or three planer drives, in one unit. It serves as a powerful, efficient drive at both high and low speeds and combines the ruggedness and efficiency of a single-circuit planer with all the speed required for carbide tools. It has two hydraulic cylinders with different area capacities. Solenoid-operated selector valves direct oil from the pump to either cylinder, or both in combination. Since the pump delivery can be applied to three distinct areas, three force ranges are available with three inversely proportional speed ranges.

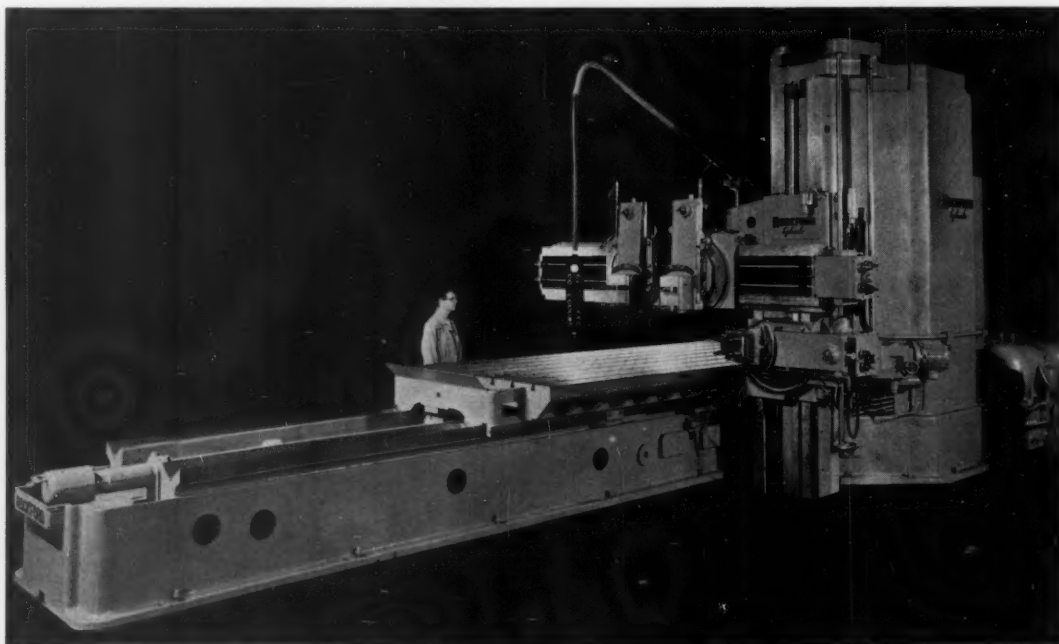
The drive is of the reversing circuit type which absorbs the

deceleration of the table and the work load within the hydraulic system. Acceleration is controlled by the servo-operated reversing pump control. Reversals are smooth, shockless, and accurate over the full range of cutting speeds.

To further simplify the operation of the planer, speed-range selection and cutting-speed adjustment are available from the pendant. A direct-reading tachometer dial is provided to indicate the exact speed at which the table is traveling at all times. Return speed is independent and infinitely adjustable. Maximum return speed is available automatically at any cutting speed.

Cutting speed may be increased or decreased from the pendant by push-button while the machine table is running. Stepless adjustment in all ranges, from 0 to maximum, is available. Range selection is by means of a selector switch on the pendant. Feed actuation at either the start or the end of the normal cutting stroke may also be selected by a switch on the pendant.

Circle Item 110 on postcard, page 261



"Hy-Draulic" planer with "Elecdraulic" control brought out by the Rockford Machine Tool Co.

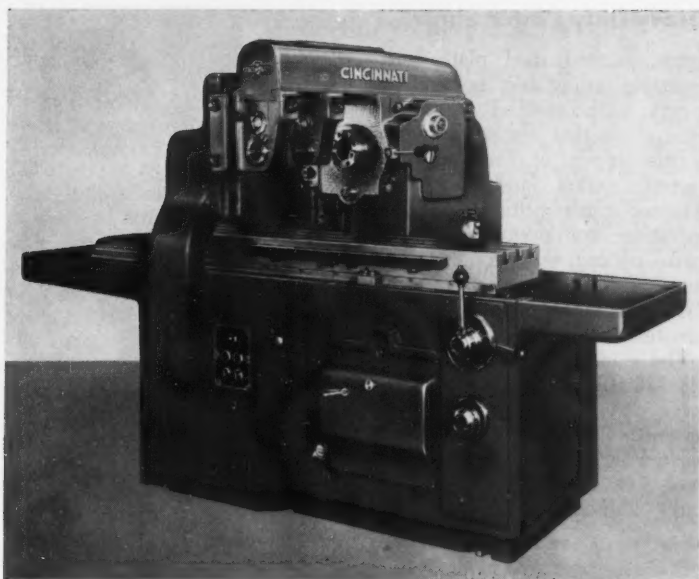


Fig. 1. Plain rise-and-fall style "Powermatic" milling machine

### Cincinnati "Powermatic" Milling Machines

A line of automatic milling machines, called "Powermatics," designed to combine a sturdy spindle drive with convenient, quick set-up features and rapid, fully automatic table and spindle-carrier cycles, has been announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio. The machines are built in plain, duplex, and plain rise-and-fall styles. "Powermatics" offer cutting capacities up to 10 H.P. and spindle speeds up to 3000 R.P.M. for taking conventional milling or climbing cuts with either high-speed steel or carbide cutters.

The plain rise-and-fall style machine, Fig. 1, will automatically take closed-end cuts and cuts requiring a retraction of the cutter to clear an obstruction on the work or fixture. The duplex style machine, Fig. 2, has spindle-carriers that remain fixed in relation to table traverse. Standard "Powermatics," designated the 200 series, are built in seven sizes of each style, from No. 205-112 (24-inch table travel, 5 H.P.) to No. 210-118 (96-inch table travel, 10 H.P.).

Automatic cycles and manual control have been combined to an unusual degree for production type milling machines. Through a

cycle-selector unit, a single lever initiates the complete milling operation, including automatic table cycle, spindle stop, backlash eliminator, spindle-carrier cycle of rise-and-fall machines, and spindle retraction when this equipment is supplied.

Standard automatic table cycles feed to the right or left, or al-

ternately right and left, with a center stop position for safety. Rapid traverse is at the rate of 300 inches per minute. Sixteen table feeds, ranging from 1/2 inch to 20 inches per minute, are obtained with change-gears.

To protect the operator, gears stop rotating when the hinged covers over the change-gear stations are opened. This is accomplished through contact buttons in the electrical circuit. Sixteen spindle speeds can be obtained through change-gears and a back-gear combination. A choice of three ranges of spindle speeds is available: 75 to 3000 R.P.M., 50 to 2000, and 30 to 1200 R.P.M. Range and horsepower are interrelated.

Vertical feeds for the spindle-carrier of rise-and-fall machines are infinitely variable from 1 inch to 40 inches per minute, obtained through a dial control. Feed cycles are initiated and synchronized with the table cycles by the cycle-selector unit. Adjustable stops, engaging the teeth of a fixed rack, may be set to utilize any portion of the 8-inch vertical range. The standard rise-and-fall machine feeds down only and rapid traverses up and down at the rate of 100 inches per minute. However, the machine can be arranged to feed up and down for box milling.

Circle Item 111 on postcard, page 261

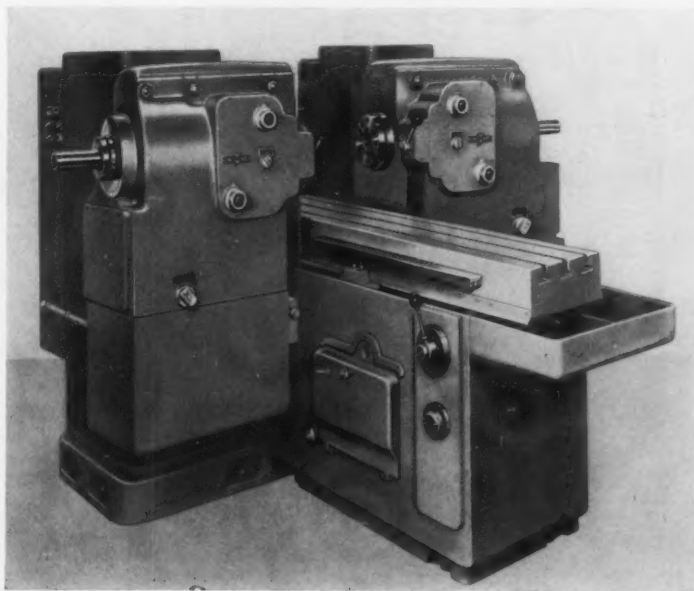


Fig. 2. Duplex style Cincinnati "Powermatic" milling machine

## Lodge & Shipley High-Speed Heavy-Duty Power Shear

A 24-inch production shear has been announced by the Lodge & Shipley Co., Cincinnati, Ohio. This "Speed Shear" is built for fast, heavy-duty power shearing. It has a blade length of 24 inches, a throat depth of 7 1/2 inches, and will cut mild steel up to 1/8 inch thick. It operates at speeds up to 120 strokes per minute and is 50 inches wide, 50 inches deep, and 72 inches high.

This shear will do straight and angle shearing, sequence shearing, slitting, notching, blanking, and accurate duplication of straight-side parts without the use of dies. The special table, which extends around the left end of the blade, is provided with tapped holes for quick, accurate set-up of protractors, clamps, and cutting guides. For regular shearing, a front-operated back gage is used.

Important features of this shear include: provisions for making all adjustments at the front of the machine; table designed for sit-or-stand operation; counter-thrust slide for burr-free cutting; perfected solenoid-operated safety

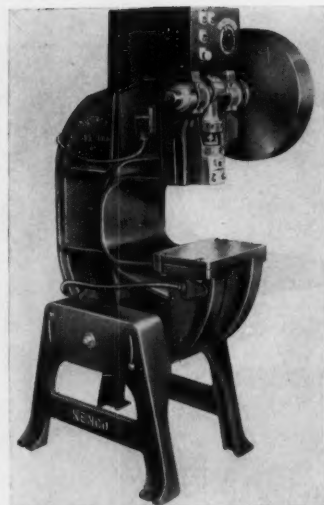
clutch; rugged steel plate construction; adjustable hold-down fingers with molded neoprene cups; chute that discharges work to front or rear of machine; foot-control switch and machine-mounted push-buttons; selective operation; continuous or single-stroke cutting; see-through finger guard; fully enclosed drive; and fluorescent light gage which illuminates the table.

The machine is furnished with a 1 1/2-H.P. motor and a three-belt V-drive. Protractor and guides for cutting are also provided. Capacities include 1/8 inch in mild steel, 3/32 inch in stainless steel, and 7/32 inch in duralumin.

Circle Item 112 on postcard, page 261

## Kenco Deep-Throat Punch Press with Safety Features

Kenco Mfg. Co., Los Angeles, Calif., has brought out a 15-ton deep-throat punch press which has the same safety and mechanical advantages as the company's 15-ton Electro-Safe standard



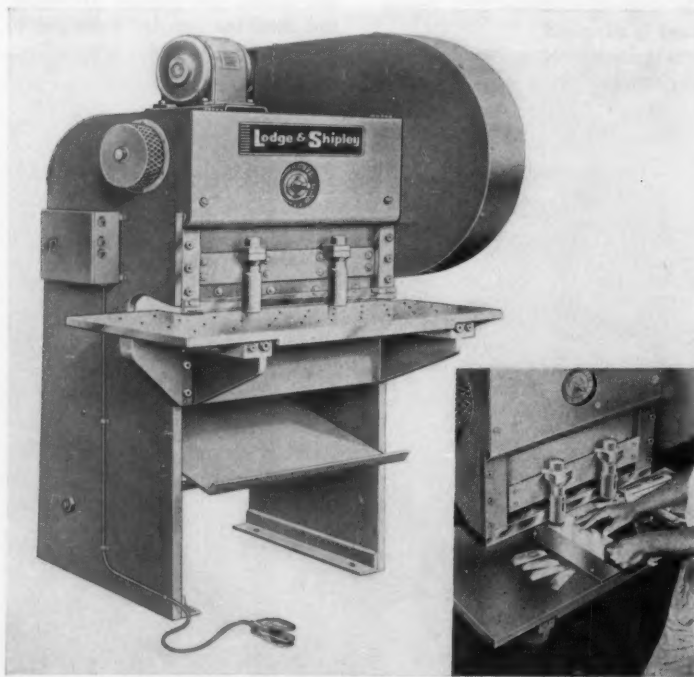
Deep-throat punch press with safety features made by the Kenco Mfg. Co.

model press. The deep-throat Electro-Safe press has no fly-wheel and thus eliminates stored-energy and double-tripping hazards. Mechanical clutching, too, has been eliminated. Consequently, noise, vibration, and accidents normally connected with clutching cannot occur. The stroke is powered by an electrical surge which starts the motor from a dead stop. The motor stops at the end of the stroke cycle.

Two single-trip buttons are widely spaced to keep the operator's hands clear of the danger zone. The operator must push both buttons at once and hold them down until the bottom of the stroke is reached. The buttons are then released preparatory to starting a new cycle. A heavy-duty safety brake is applied whenever power is disrupted or disconnected, and a safety stop button halts the press instantly at any point in the cycle. Thus, the operator and equipment are safeguarded should mechanical or electrical failure occur.

Versatile controls permit the operator to change from single-trip to continuous-stroke, inching, two-hand, or foot control by merely turning a dial. This selector switch can be locked in position so that the operator cannot expose himself to danger by varying the setting.

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Lodge & Shipley "Speed Shear." Inset shows close-up of sequence shearing of aluminum gussets in aircraft plant.



### Gisholt "Masterline" Turret Lathes

"Masterline" ram type universal turret lathes that are new throughout, both in styling and construction, have been brought out in three basic models by the Gisholt Machine Co., Madison, Wis. These lathes are built to provide faster, easier operation than preceding models. They have increased power and higher spindle speeds for more efficient use of the latest cutting tools.

The No. 3 lathe takes round bar stock up to 1 1/2 inches in diameter and the No. 4 will handle round bar stock up to 2 inches in diameter. The No. 5 lathe can be furnished to take either 2 1/2- or 4 1/4-inch round stock through the spindle. All models can be equipped with the Gisholt "JETracer," mounted on the rear of the cross-slide or on a single turret face. Each machine can also be furnished with a Lynn hydraulic drive unit as a part of the original equipment to provide completely automatic operation. One-piece, replaceable, hardened and ground steel bedways are standard. A cast-iron chip pan, motor, and coolant reservoir are incorporated in the cabinet legs of the machine.

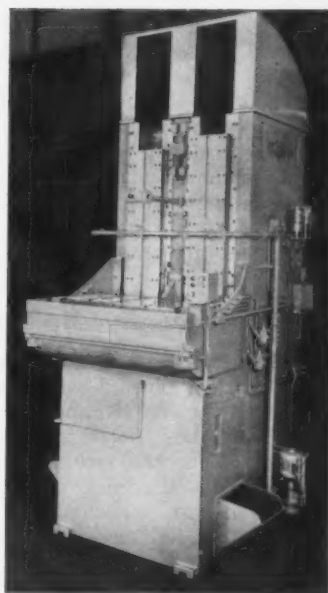
The hydraulic speed selector

offers a choice of "direct" or "pre-set" operation. Spindle speeds may be selected with reference to work diameters and surface speeds in feet per minute. A convenient "high-low" trip-lever permits an instantaneous speed change in a ratio of 8 to 1 when changing from drilling, turning, or boring to threading, forming, or reaming operations.

Circle Item 114 on postcard, page 261

### Colonial "ElectroGear" Dual-Ram Vertical Broaching Machine

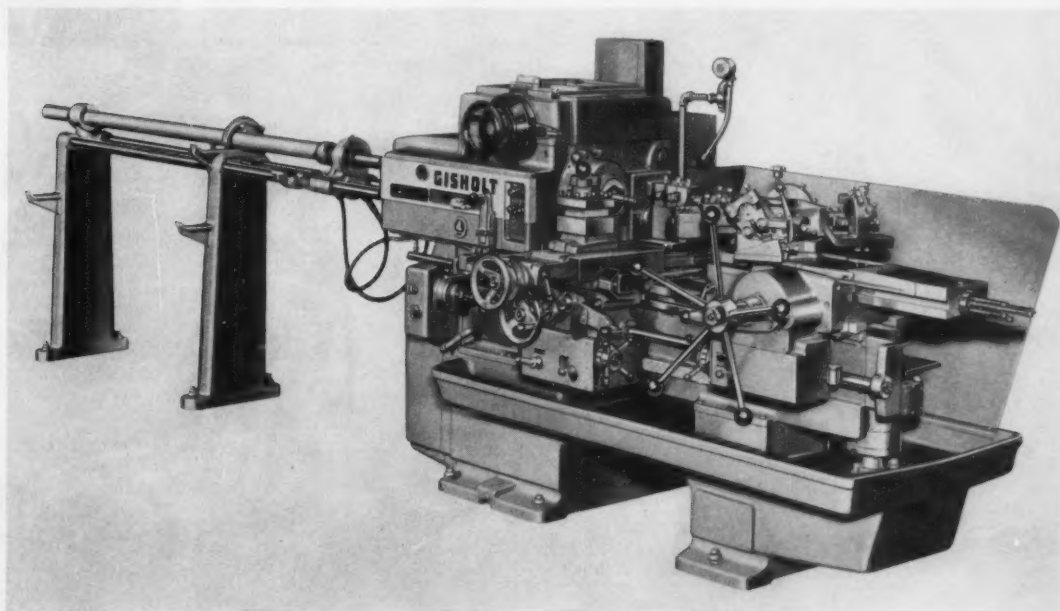
A complete line of 15-ton capacity "ElectroGear" dual-ram vertical broaching machines is announced by the Colonial Broach & Machine Co., Detroit, Mich. Exceptionally smooth operation is an outstanding feature of these machines. This characteristic is achieved through helical pinion-rack drives and balanced power loading made possible through the interaction of the ascending and descending rams. The smooth flow of power to the tool results in broached surfaces of improved finish obtained by a 50 to 100 per cent faster cutting stroke. The



Colonial 15-ton, 80-inch stroke, dual-ram broaching machine

pinion-rack drive is by a variable-speed, direct-current motor powered by a motor-generator set. While one ram is descending on the cutting stroke, the other ram is returning to the starting position.

Five basic models are available with stroke lengths of 54, 66, 80,



"Masterline" ram type universal turret lathe brought out by the Gisholt Machine Co.

90, or 100 inches. Hardened and ground box or vee type ways are available on all five models. Broaching speeds range up to 80 feet or more per minute. The ram speed is infinitely variable between minimum and maximum to give optimum broaching speeds.

Ram ways are pressure-lubricated, and all gears are auto-

matically lubricated. Hydraulic power is provided to operate the work-holding fixtures and is interlocked with the machine cycle. All hydraulic and electrical controls are interlocked and installed in accordance with J.I.C. standards. Tables and fixtures are hydraulically actuated.

Circle Item 115 on postcard, page 261

### **Norton Automatic Machine for Grinding Stem Pinions**

An automatic machine for grinding stem pinions has been developed by the Norton Co., Worcester, Mass. Important features of this machine include special work-holding and driving equipment with automatic loading and unloading devices. Automatic controls permit one operator to supervise the production of more than one of these machines. Many of the features of Norton's CTU cylindrical grinders are incorporated in this special-purpose grinder.

The pinions are placed in a loading chute from which each

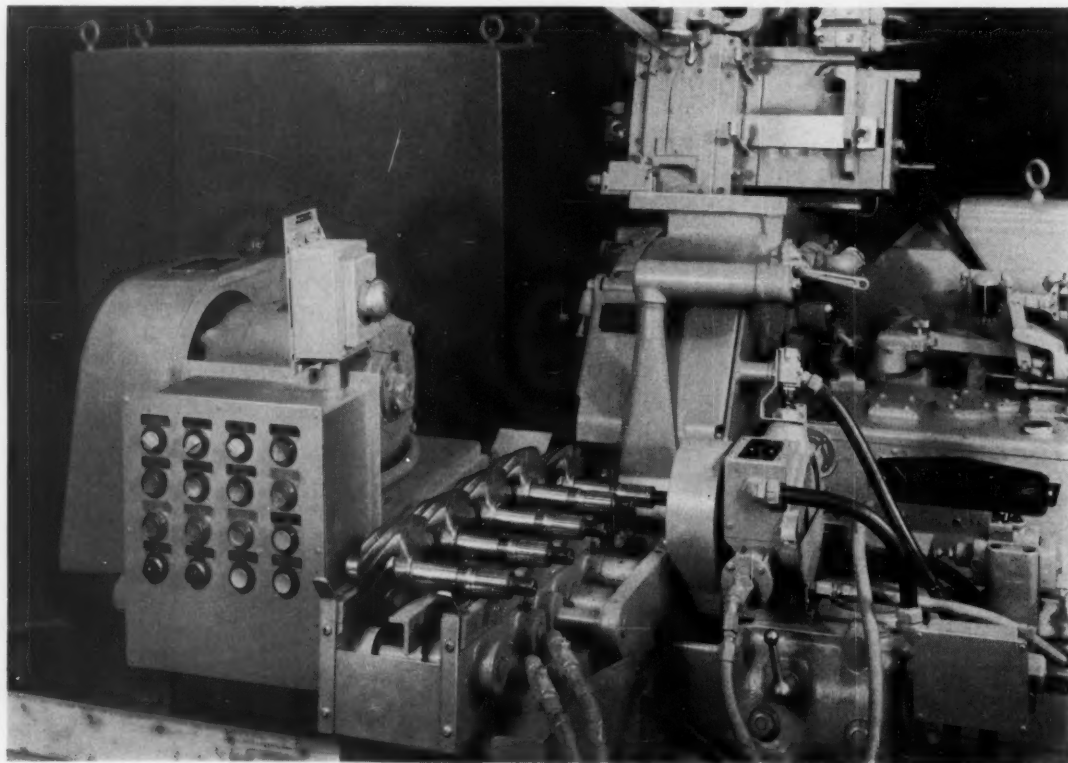
one is automatically moved down inclined ways toward a revolving turret. The turret places the pinion in position for the footstock center to engage the center hole and pushes it forward into the floating type collet on the headstock. The grinding cycle time is pre-selected on the basis of stock removal and finish requirements. Upon completion of the grinding operation, the revolving turret takes the pinion from the centers and discharges it into an unloading chute from which it rolls onto the conveyor at the front of the machine.

Grinding wheel truing and forming are performed automatically at predetermined intervals by a time-saving device mounted on the wheel-head. In addition, this device gives close control of the amount of abrasive removed from the wheel face. The wheel-head is automatically reset to compensate for the reduced wheel diameter after truing. Interlock controls assure that automatic actions occur in their proper order. Any deviation from normal or correct operation causes the machine to stop.

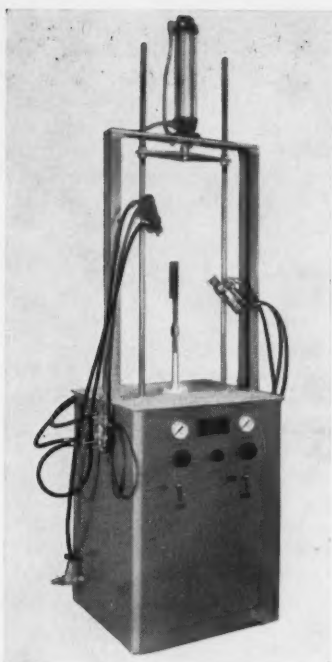
Circle Item 116 on postcard, page 261

### **Automatic Spray Painting Machine**

An automatic machine for painting cylindrical and rectangular parts, such as tubes, bottles, and model trains, has been developed by the Conforming Matrix Corporation, Toledo, Ohio. This machine has vertical traveling paint guns which spray either on the down stroke or on both the



Automatic machine for grinding stem pinions developed by the Norton Co.



Automatic spray painting machine made by the Conforming Matrix Corporation

down and up strokes, as desired. The work-holding spindle can be set to remain stationary or adjusted to rotate at speeds ranging from 50 to 400 R.P.M.

The machine is completely air-operated, and has a low-pressure hydraulic cylinder drive for smooth, adjustable gun travel in both directions. A spindle stopping-locating device facilitates easy loading and unloading of work. The unit is furnished complete with two automatic spray guns, speed controls, atomizing air regulator, necessary hoses, and fittings. The air-operated valves and other moving parts are automatically oiled.

Circle Item 117 on postcard, page 261

### "Blutex" Tracing Vellum

The Frederick Post Co., Chicago, Ill., has announced an improved tracing vellum called "Blutex" that permits clean erasure of pencil lines. A combination of transparentizing materials used in treating the base stock is said to provide the exceptional

erasing qualities. "Blutex" is treated with 100 per cent synthetic resins rather than oils. The carefully selected resins are said to provide a "drier" working surface of unchanging characteristics. While dry, the paper is never brittle. This unusual dryness, combined with an extra-hard surface, permits faster and cleaner erasures.

Materials are specifically formulated to resist heat and aging. The transparentizing agents will not fuse with the graphite lines, thus eliminating a condition that makes lines difficult to erase. Fine drawing characteristics for opaque graphite lines are also claimed for the dry surface of the "Blutex" vellum.

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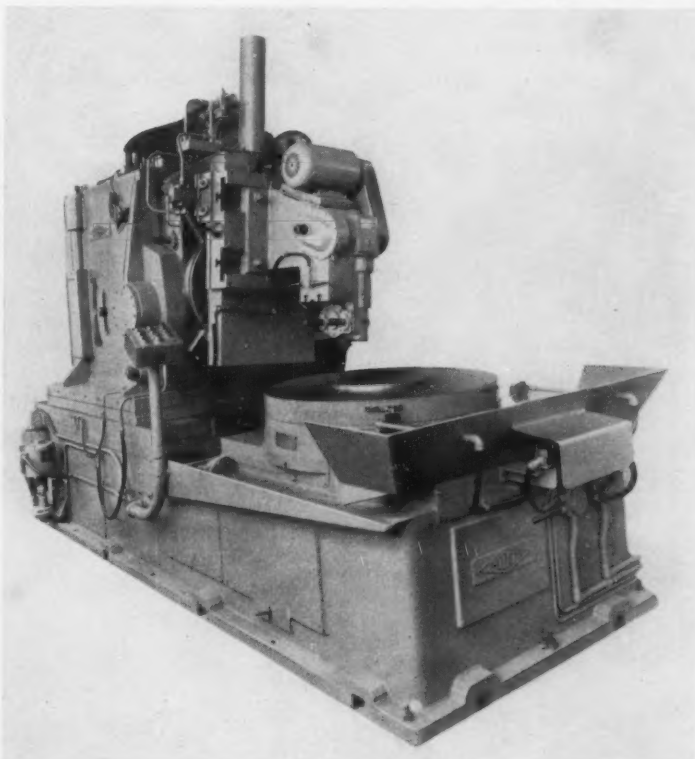
### Producto Index "Mill-Matic" for Machining Jet-Engine Components

A Model ST-50 index "Mill-Matic" machine for automatic external or internal milling of slots, scallops, and lugs in jet-engine components is announced by the Producto Machine Co., Bridgeport, Conn. The versatility of this improved model has been increased by the addition of an adjustable angle milling head, a dual spindle, and a variable spacing index.

The vertical slide can be swivelled up to 30 degrees either side

of the vertical position in one plane and can be tilted up to 10 degrees either side of vertical in the other plane. It has a stroke of 20 inches with necessary controls for any combination of feeds and approach strokes.

The milling head is designed with two spindles so that the work-piece can be machined either externally or internally. The automatic type index mechanism has a capacity of up to 150 divisions and can also handle a vari-



Index "Mill-Matic" equipped for milling jet-engine components introduced by the Producto Machine Co.



Magnetic separator and filter made by the Industrial Filtration Co.

ety of spacings if necessary. Work capacity is from 18 to 54 inches.

Other features are a completely automatic cycle and necessary controls for jogging, etc., as required for set-up purposes. The speed range of the milling head is from 30 to 350 R.P.M. and the feed range is from 1 to 30 inches per minute. Rapid traverse is at the rate of 250 inches per minute. The entire spindle and ram can be retracted to facilitate loading and unloading large, bulky pieces.

Circle Item 119 on postcard, page 261

### Delpark Magnetic Separator and Filter

A Delpark, 200-gallon magnetic separator and filter for filtration processes requiring large flow capacities is announced by the In-

dustrial Filtration Co., Lebanon, Ind. This unit—said to be the largest of its kind—is designed for the removal of sludge and abrasives by the use of a flat magnetic field of Alnico No. 5 permanent magnets. The ferrous-laden liquid flows over the magnetic field diffusing liquid and particles, thus assuring complete exposure to the magnets and making it possible to hold the liquid depth to a minimum. Particles that normally remain suspended in a liquid of heavy viscosity are brought into more positive influence of the magnets. The natural force of gravity and low-velocity flow aid in efficient separation of ferrous sludge and abrasives.

Because certain particles such as wheel abrasives do not respond to a magnetic field, the magnetic separator has been combined with the Delpark paper filter.

Circle Item 120 on postcard, page 261

### Seneca Falls Automatic Lathe Equipped for Specialized Production Job

Removing welding flash from a worm-shaft assembly on a high-production basis has been facilitated by the Seneca Falls Ma-

chine Co., Seneca Falls, N. Y., by equipping their Model "LN" automatic lathe, Fig. 1, with certain standardized units. This special-

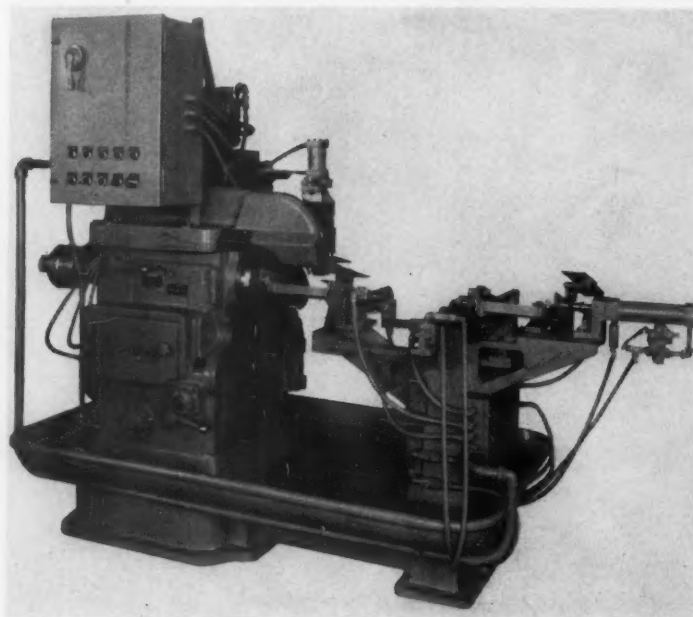


Fig. 1. (Left) Seneca Falls automatic lathe designed for specialized high-production work requiring handling of red-hot welded worm-shaft. Fig. 2. (Right) Work-piece held in chuck and steadyrest rolls while a second piece is shown ready to be injected into the loading position



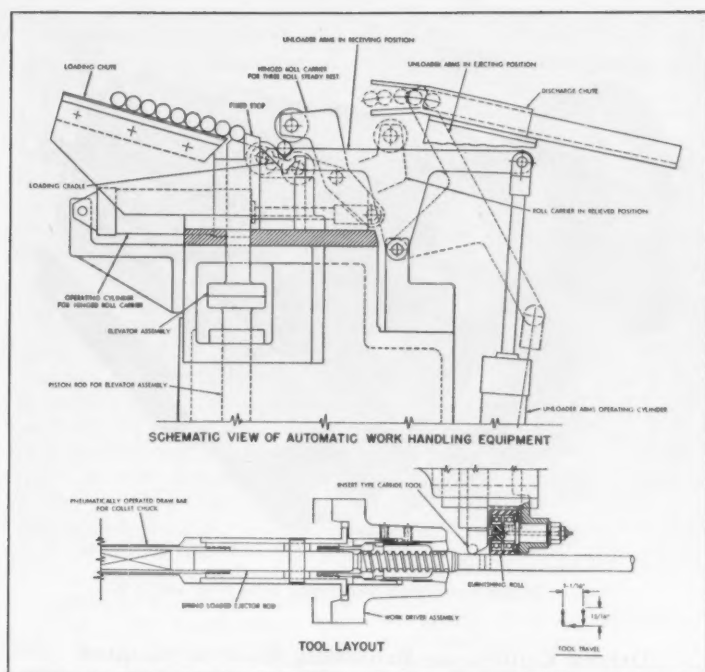


Fig. 3. (Upper view) Diagram showing work-handling equipment of lathe illustrated in Fig. 1. (Lower view) Diagram illustrating method of holding and driving work and arrangement of carbide tools employed on Seneca Falls automatic lathe

ized high-production machine affords substantial savings in initial equipment costs.

The upper diagram, Fig. 3, shows the automatic work-handling equipment. Welded parts are delivered to the lathe red-hot directly from the welding machine by a conveyor which joins the loading chute. The parts flow by gravity to a fixed stop at the loading position. On completion of a finish-turned part, the spindle stops, the hinged steadyrest roll-carrier is retracted, the collet chuck opens, and the finished piece is ejected from the collet by a spring-loaded ejector-rod. The part is deposited on the unloader arms which immediately swing the finished piece into the discharge chute and then return to the receiving position.

At this point, an elevator assembly raises a rough piece over the loading chute stop and into the loading cradle, which remains in the raised position until the part is injected into the collet chuck by the pneumatically operated plunger. The collet chuck

closes immediately, the elevator assembly retracts, the hinged steadyrest roll-carrier automatically closes, the headstock spindle clutch engages, the tools on

the overhead slide advance to the cutting position, remove the flash and burnish the work, after which the tools retract and a new cycle begins.

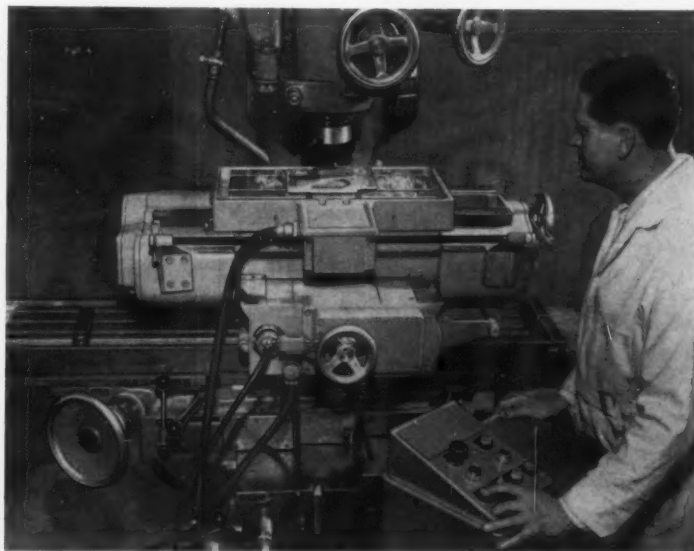
The lower diagram in Fig. 3 shows the method of holding and driving the part in a collet chuck and also the location of the insert type carbide tool used for removing the hot flash. The burnishing roll used to smooth and evenly match the junction of the welded parts is also shown.

The entire loading, machining, and unloading operations are automatic; however, push-button controls are installed for the manual operation of each movement. The loading cycle cannot get out of time since the automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding one.

Circle Item 121 on postcard, page 261

## Tape-Controlled Indexing Table

A precision-made, automatic, tape-controlled indexing table has been announced by the Micro-Positioner Corporation, Santa Monica, Calif. Designated "Micro-Positioner," this unit makes possible rapid reproduction or duplication of complex pattern lay-outs



"Micro-Positioner" mounted on milling machine for performing rectangular type profiling operation

for drilling, reaming, tapping, and many other operations.

The set-up is simple. An accumulator mechanism provided with a counter which registers table travel in inches can be used for positioning the holes according to lay-out specifications, or a master part mounted on the table can be used for this purpose. Wherever a hole is indicated, its position is recorded by making an indentation on tape. In production, the sensing mechanism will position the holes in the work-piece according to the indentations. The indexing speed of the machine is variable from 6 to 90 inches per minute. The table indexes rapidly, then slows down for accurate positioning, which can be held within limits of 0.001 inch.

The "Micro-Positioner" is push-button-controlled. One tape serves to control transverse movements of the work-table, while another tape controls the longitudinal movements. These movements are governed by an electric clutch-brake which starts and stops the lead-screws instantly as the switches sense the indentations or markings on the tapes. Thus, the unit eliminates the need for jigs, fixtures, and drill bushings in performing drilling and other operations, such as the rectangular profile milling job illustrated.

Circle Item 122 on postcard, page 261

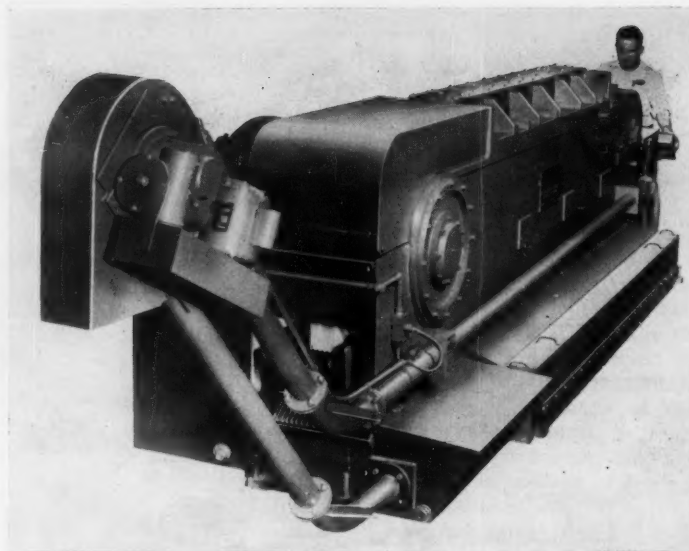


Fig. 1. Detroit continuous, horizontal broaching machine

### Detroit Continuous Broaching Machine Adapted for Automatic Operation

A heavy-duty, horizontal, continuous broaching machine is announced by the Detroit Broach Co., Rochester, Mich. Fixture-locking, operation, and unloading of this machine, shown in Fig. 1, are fully automatic, while loading can also be done automatically when required.

Easy loading and unloading of a wide variety of work sizes

and shapes are made possible by the extra fixture clearance formed by the large radius from the chain axis to the outer machine frame. A safety interlock device prevents operation until parts are positively positioned in the fixtures.

Cutting speeds up to 40 feet per minute can be obtained from the heavy-duty, twin-chain electric-mechanical drive. Other speeds are available through simple change-gears. Fixtures are of the hammer-lock type, automatically located, locked, opened, and emptied. The number of fixtures can be varied to meet almost any production requirement.

The machine is entirely self-contained, including the filtered coolant tank, pumps, and automatic chip disposal unit of the endless conveyor type. All electric and hydraulic equipment conforms to J.I.C. standards. The model illustrated has a 90-inch stroke, 15-ton capacity, and is approximately 60 inches high by 70 inches wide by 207 inches long plus chip conveyor overhang. Other 15-ton models are being built with 66- and 120-inch strokes, while lower and higher tonnage capacities are also available.

Circle Item 123 on postcard, page 261

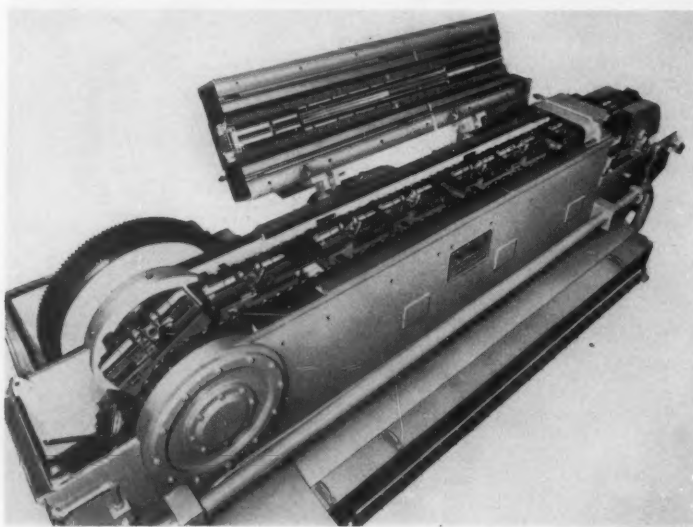


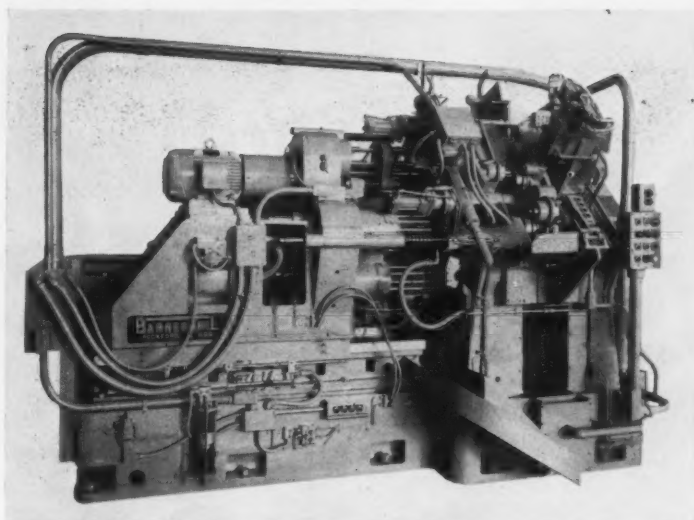
Fig. 2. Broach-carrying tunnel of machine illustrated in Fig. 1 raised to show twin-chain work-conveyor and hammer-lock fixtures

### Automated Eight-Station Drum Type Machine

Four Barnesdril special, eight-station, drum type machines have recently been completed by the Barnes Drill Co., Rockford, Ill., for use in a large automotive plant. These machines can be employed for completely automated drilling, chamfering, reaming, and tapping of a rear-axle drive gear.

The gears are delivered by conveyor to a loading pocket on the machine. With a completely interlocked cycle, the gears are automatically picked up by means of a loading arm which moves them to the loading position. There, they are clamped in the holding fixture. In order to minimize the cycle time for the operation, the drilling is divided and performed at the second and third stations. At the fourth station, the holes are cleaned by a chip blow-out unit and gaged by an automatic probing unit. Chamfering takes place at the fifth station.

All holes are reamed at the sixth station. Five holes are tapped at the seventh station, and the remaining five are tapped at the eighth station. After the part has been indexed back to the first station, it is automatically unclamped and the unload-



Barnesdril special automated machine for processing rear drive gears

ing arm picks it up and moves it to the discharge chute.

If inadequate depth of the holes or broken tools are found by the probing unit at the fourth station, the machine is automatically stopped and a warning sig-

nal is actuated. The machining cycle is resumed after the part has been removed through the reject chute, and tool corrections are made. Production exceeds 200 pieces per hour.

Circle Item 124 on postcard, page 261

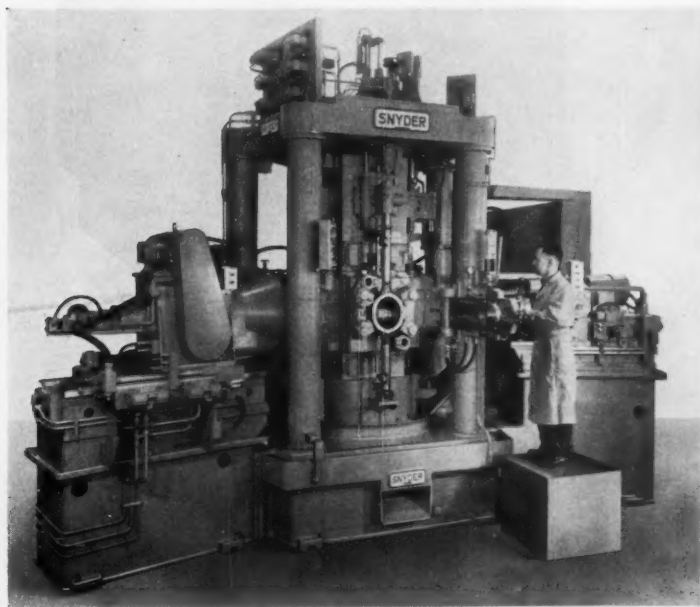
### Snyder Vertical-Trunnion Index Machine

A five-station, vertical-trunnion index machine for processing long parts such as automotive axle

housings is announced by the Snyder Tool & Engineering Co., Detroit, Mich. This machine has the space-saving advantage of a center-column type machine tool, but has no index-table as such. Instead, the center column itself holds the work-fixtures and rotates the parts from station to station. Upper and lower tapered roller bearings support the trunnion. Four tubular steel columns support the upper outboard bearing frame.

The hydraulically operated, electrically controlled machine illustrated rough- and finish-faces the housing banjo flange, drills and reams ten holes in the flange mounting face, and chamfers both sides of the holes. It produces 105 housings per hour at 100 per cent efficiency. Three single-point carbide tools are used to rough- and finish-face the flange. This type of tool design was selected to avoid the large thrust loads developed when conventional spot-facing tools are used on such large di-

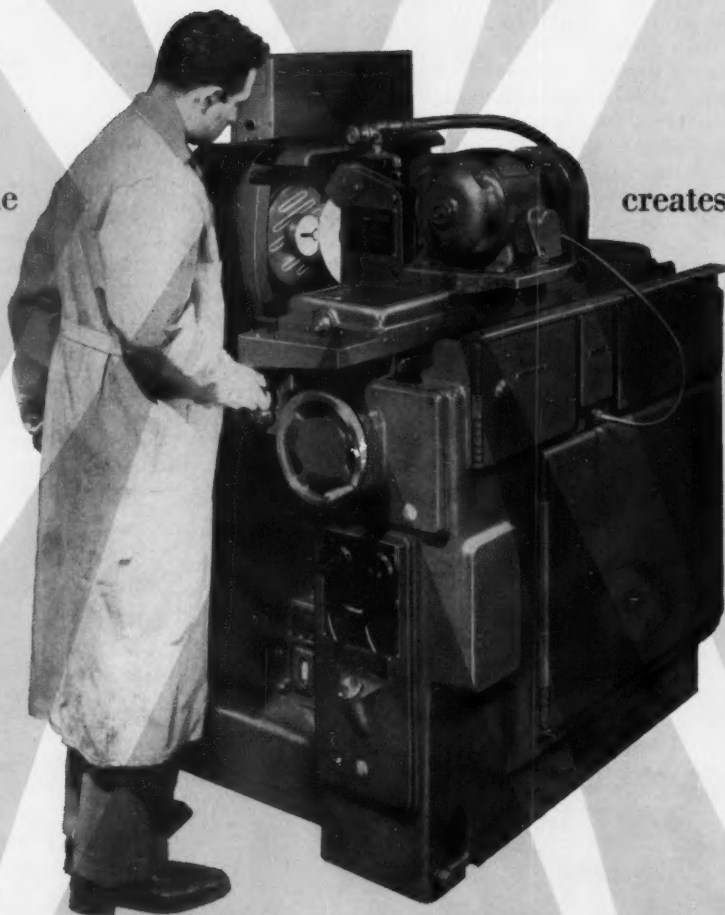
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Snyder vertical-trunnion index machine for processing slender parts

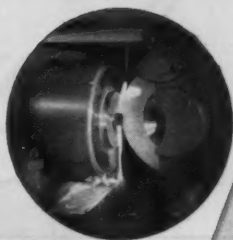
this advanced machine

creates . . .



The Brown & Sharpe No. 11 Face Grinding Machine

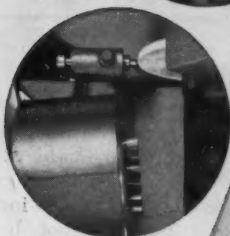




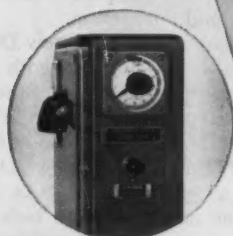
**Exclusive Horizontal Work Spindle**  
Aids coolant in flushing work —  
assures finer quality surfaces.  
Provides a natural loading position  
for automated lines.



**Exclusive Lever Control of Work Holders** Permits speedy chucking, minimizes loading time. Work-holding by either permanent magnet chuck or face chuck.



**Exclusive Set-Diamond Dressing**  
Eliminates need to re-establish wheel position after each dressing. Available as an automatic feature for top economy of wheels and diamonds — positive protection for size.



**Automatic Cycle and Spark-Timing**  
An "optional" that makes operation completely automatic — assures repeat accuracy.

## New Possibilities in Face Grinding!

*greater accuracy  
greater versatility  
greater economy*

Now there's a truly advanced face grinding machine that lends itself perfectly to *any* loading technique — manual or automatic! It's the new Brown & Sharpe No. 11 Face Grinding Machine . . . unmatched for precise, efficient, economical grinding of flat, concave, and convex work up to 10" diameter and  $4\frac{3}{4}$ " thickness. Four of its outstanding design features are illustrated on these pages. There are *many* more — advantages that make it the most valuable face grinder available for either toolroom work or high production. Write for complete details.  
Brown & Sharpe Mfg. Co.,  
Providence, Rhode Island.



Ask About Our Pay-as-You-Depreciate  
Machine Tool Plan

# **Brown & Sharpe**

ameter work. The individual carbide tools are mounted in block assemblies that are pre-set and ground. A large hydraulic cylinder advances the tools across the face by means of a draw-bar and bellcrank mechanism.

Chuckling of the welded housing assembly is a critical operation. First, the housing is loaded in the fixture over a lower arbor that enters a semifinished bore. Then, the upper arbor enters the semifinished bore in the other end of the housing. Next, a centralizing locator on a swinging gate is moved into position in the housing. A jaw chuck then clamps the housing flange section, based on the location indicated by fingers on the locator which bear on the inside surface of the outer flange. When the locator gate is swung out of the way, the machine indexes to the first working station.

The heads for the machining

	DoALL Standards	National Bureau of Standards
Size (Length Flatness Parallelism)	AAA New Grade $\pm .000001$	No standard yet set for this fine accuracy
	AA Grade $\pm .000002$	AA Grade $\pm .000002$
	A Grade $+.000004$ $-.000002$	A Grade $\pm .000004$
	B Grade Discontinued	B Grade $\pm .000008$
Finish	0.09 Microinches	0.6 Microinches
Serially Numbered	Yes	Recommended -- not required
Burr Proofing	Yes	Not Required

Fig. 1. Chart giving tolerances set up for gage-blocks by the National Bureau of Standards and tolerances established for DoALL gage-blocks

functions performed at the four work-stations are mounted on standard Snyder way type units. The machine occupies a floor space about 214 by 148 inches.

Circle Item 125 on postcard, page 261

## DoALL Gage-Blocks Made to Newly Established Standards

The DoALL Co., Des Plaines, Ill., has established an entirely new category of gage-block standards with its introduction of "AAA" grade blocks made to the very close tolerances of plus or minus one millionth of an inch (0.000001 inch) per inch of length. Other

improvements have been made in the new gage-blocks.

To establish the new dimensional standards for its gage-blocks, DoALL has perfected a process that gives an ultra-fine surface finish of 0.09 micro-inch r.m.s. Blocks with this finish can

be used for measurements that are accurate to tenths of a millionth of an inch. In contrast, blocks having a 1 micro-inch r.m.s. surface finish cannot be accurately calibrated closer than two millionths of an inch. This ability to read such minute deviations enables the manufacturer to produce gage-blocks of far greater accuracy, with respect to size, flatness, and parallelism.

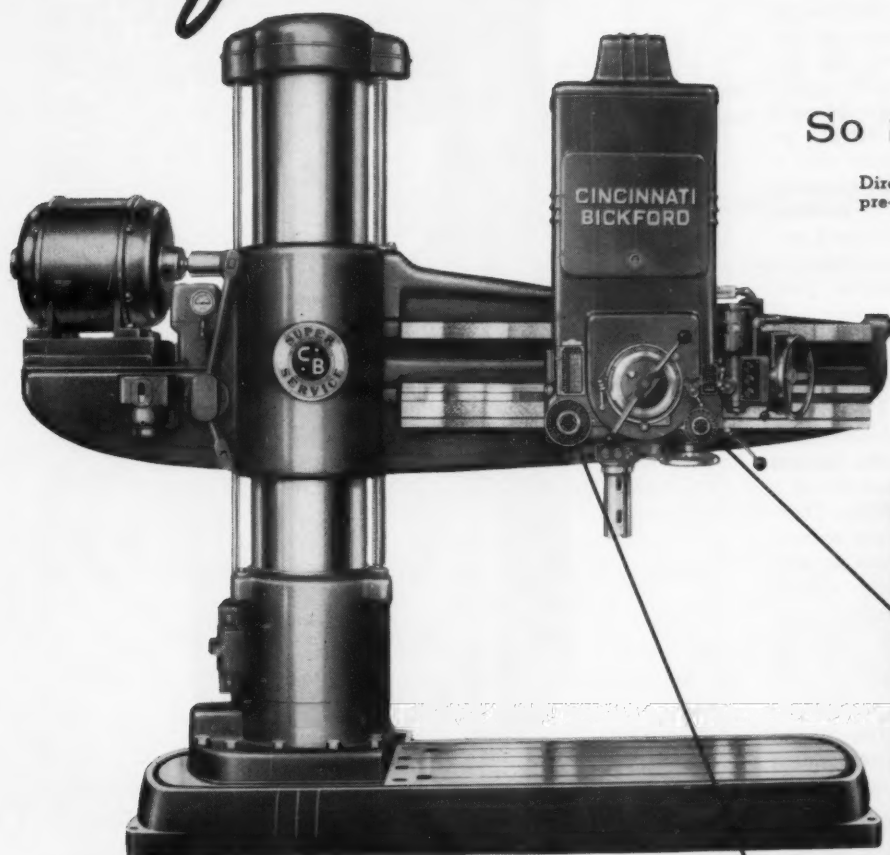
Comparison of the new DoALL gage-block standards with those set up by the National Bureau of Standards, as shown in Fig. 1, gives a better understanding of the value of the new DoALL "AAA" grade gage-blocks. Made to one millionth of an inch accuracy to serve as the ultimate in length standards for master reference in critical work, the "AAA" gage-blocks are available in square or rectangular type blocks in sets of eighty-six pieces as shown in Fig. 2. DoALL "AA" grade gage-blocks are being taken out of the "laboratory" priced category and offered at the price of the former "A" grade blocks, so that they can be put to use for routine inspection work. The "A" grade blocks are offered at the price of former "B" grade blocks. The new blocks are burr-proofed so that the gaging surfaces blend into a parabolic corner break that leaves no trace of a sharp edge. Each set of gage-blocks has a certified inspection report giving the size of each block to the nearest millionth of an inch.

Circle Item 126 on postcard, page 261  
(This section continued on page 234)



Fig. 2. DoALL "AAA" grade gage-blocks comprising set of eighty-six pieces

So *quick*... So EASY...



So SIMPLE...

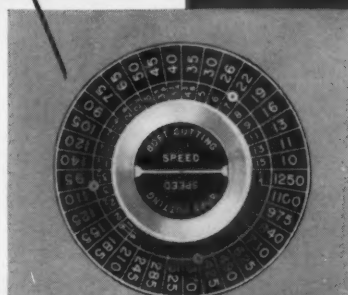
Direct and quiet shifting into pre-selected speeds and feeds.



**HYDRAULICALLY  
PRE-SELECTS**  
all 18 feeds

Positive geared tap leads and feeds are quickly pre-set.

Super-Service Radials are available with complete hydraulic pre-selection of all 36 speeds and 18 feeds. Two convenient direct reading dials control the automatic shifting of sliding gears. While the tool is cutting, merely set the dials to the speed and feed for the next operation. As the spindle is stopping for inserting the next tool, the shifting is done hydraulically... directly, quietly and quickly. No other operations—no loss of time. Write for catalogs.



**HYDRAULICALLY  
PRE-SELECTS**  
all 36 speeds

Speeds and tool diameters shown in large easy to read figures.

**CINCINNATI  
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RADIAL AND UPRIGHT DRILLING MACHINES

**CINCINNATI BICKFORD DIVISION**

GIDDINGS & LEWIS MACHINE TOOL COMPANY

OAKLEY, CINCINNATI 9, OHIO, U.S.A.

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—233

### Precision Surface Grinder

The Abrasive Machine Tool Co., Providence, R. I., has brought out an entirely new precision surface grinder designated No. 618. This 6- by 18- by 12-inch machine has been developed in response to the demand for a small, yet rugged, precision grinder that is easy to operate and maintain. Roller-bearing ways, a backlash eliminator on the saddle feed, and a unique cable and drum type drive for the table provide positive precision control.

When equipped with a 12-inch grinding wheel and spindle, the machine has a 2-H.P. motor that operates at a speed of 1750 R.P.M. Machines with a 7-inch size grinding wheel and spindle have a 1-H.P. motor that operates at a speed of 3450 R.P.M. These motorized spindles have a powerful, positive drive with no slippage. The large diameter spindle assembly is totally enclosed and dynamically balanced with the rotor in place. The spindles are life-time lubricated and have labyrinth seals at either end to exclude foreign matter. The 12- and 7-inch wheel spindle heads are not interchangeable.

(Continued on page 238)

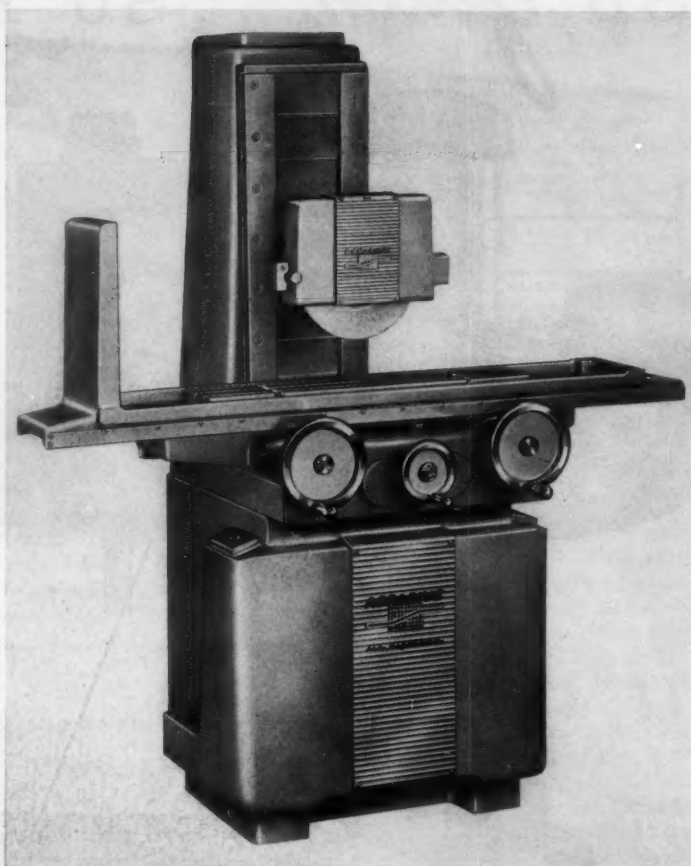


Fig. 1. Precision surface grinder brought out by Abrasive Machine Tool Co.

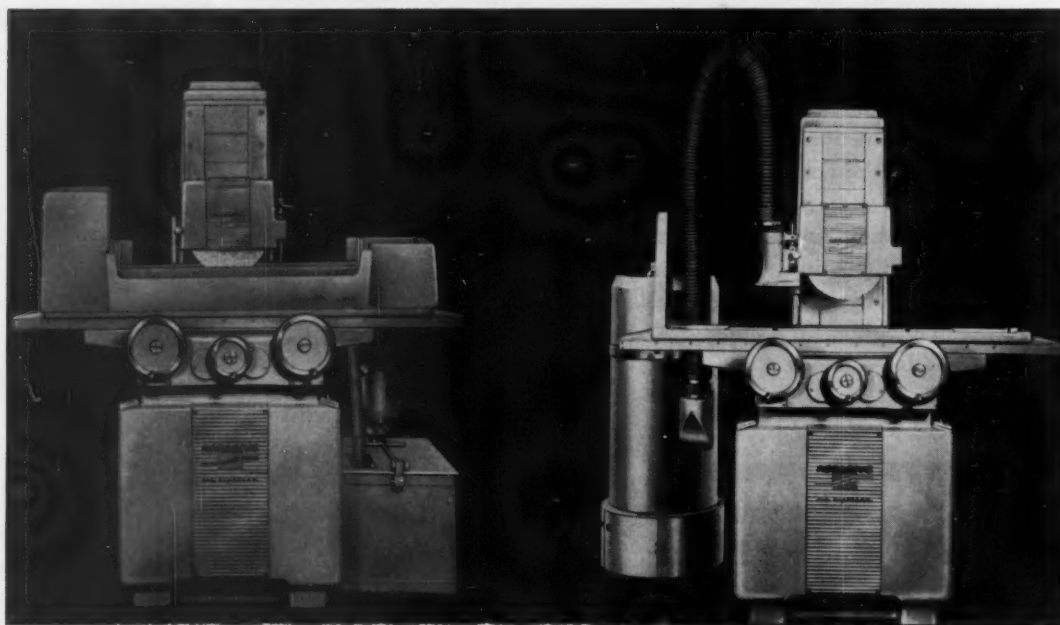
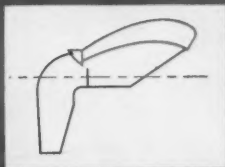


Fig. 2. (Left) Precision surface grinder shown in Fig. 1 equipped for wet grinding. (Right) Machine equipped with "Dustsnaire" for dry grinding.

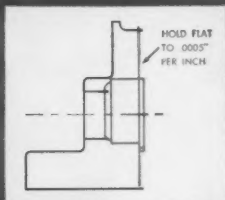


# Setup and Tooling Costs

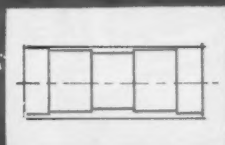
# ON THE HOUSE



Part—Piston. Material—cast iron. Operation—turn elliptical contour of 320°. 15° angle on face and short O.D. on opposite end. Comment—could not be turned economically prior to use of Air-Gage Tracer.



Part—Gear housing. Material—aluminum casting. Operations—turn, face and bore. Total machine time—3 minutes.



Part—Motor shell. Material—seamless steel tubing. Operations—face and bore both ends. Floor to floor time per piece—1½ minutes.



Part—Housing cover. Material—aluminum forging. Operations—turn, face both sides and bore. Floor to floor time per piece—4½ minutes. Previous production—7 pieces per hour.

## How One Leading Contract Shop Affords It

What's the secret of absorbing these costs—with competitive bidding and profit margins as they are in the contract shop field today?

"Simple," says C. C. Gregson, President, Illinois Gage and Manufacturing Company of Franklin Park, Ill., leading supplier of highly specialized machining of aluminum and magnesium castings. "We are able to produce a better job faster and hold close tolerances more economically than shops provided with conventional equipment. Setup and tooling is so minor that in most instances

the customer is not even charged for it."

Note that phrase "conventional equipment"—it's the pay-off! The one 16" and the two 13" Monarch lathes you see pictured below are all Monarch Air-Gage Tracer equipped. So is the 10" Monarch that isn't in the picture. There's your difference!

To quote again, "we have found they speed up production anywhere from 10% to 90%." Air-Gage Tracers in your plant would likely enable you to realize similar savings. Why not investigate? . . . **The Monarch Machine Tool Co., Sidney, Ohio.**



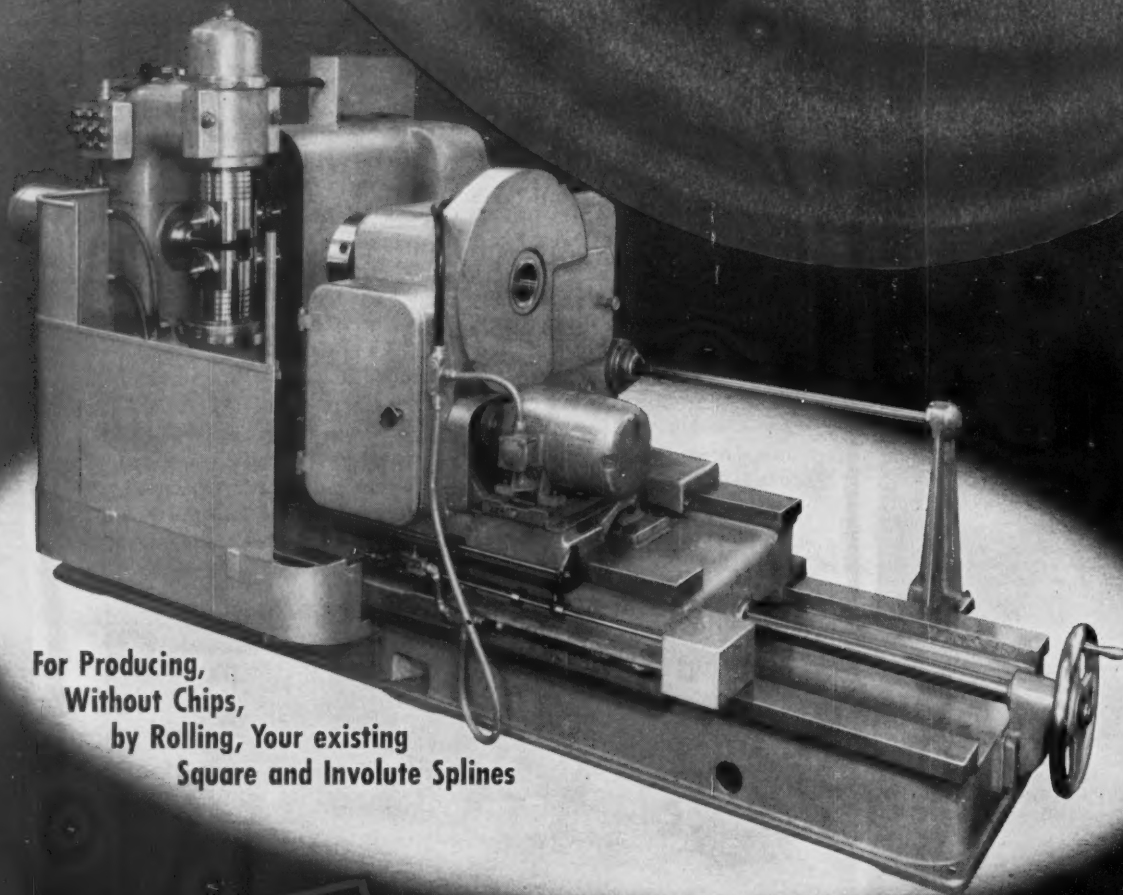
# Monarch



TURNING MACHINES

FOR A GOOD TURN FASTER  
... TURN TO MONARCH

Raising The Curtain On The  
**LEES-BRADNER** Manufactured,  
GROB PROCESS,  
**SPLINE ROLLING MACHINE**



For Producing,  
Without Chips,  
by Rolling, Your existing  
Square and Involute Splines

REVOLUTIONARY

CHIPLESS

ACCURATE

FAST

ECONOMICAL

*the* **LEES-BRADNER**  
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CLEVELAND 11, OHIO • U.S.A.

## Here's Why True Rolling Is Better

No need to redesign—use your existing profiles.

Your existing splined profiles produced in  $\frac{1}{5}$  present hobbing times.

Forming roll costs about  $\frac{1}{9}$  of hob costs—"resharpening" costs eliminated!

No chips.

Manual loading or automatic self-loading and self-unloading, as you prefer.

Splines precision produced with amazing improvement in finish.

### SPECIFICATIONS

#### Capacities

Root Diameter of work Max. 4" Min.  $\frac{3}{4}$ "

Between centers Max. 48"

Length of Spline Max. 9"

Diameter of hole through work holding spindle 6"

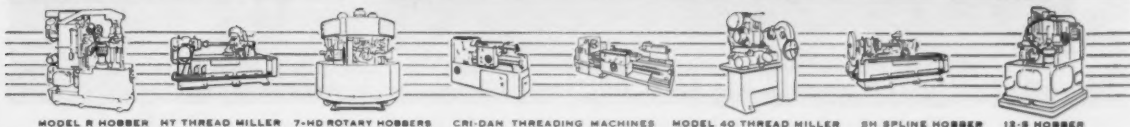
Work Spindle Speeds—1800 RPM divided by the number of teeth in the work

Motors—Main Motor 10 HP. Rapid Traverse Motor 5 HP.  
Rev. Feed Motor 5 HP. Pump Motor  $\frac{1}{2}$  HP.

Length 14 ft. Width 6'6" Height 6'0"

Weight (net) 15,000 lbs.

*the* **LEES-BRADNER**  
CLEVELAND 11, OHIO • U.S.A. *Company*



MODEL R HOBBER HY THREAD MILLER 7-HD ROTARY HOBBER CRI-DAN THREADING MACHINES MODEL 40 THREAD MILLER 5H SPLINE HOBBER 13-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER



The feed handwheels are all located in the same waist-high plane. The head elevating and table feed handwheels are located on opposite sides of the cross-feed handwheel. The elevating handwheel has 0.0001-inch graduations and the cross-feed handwheel has 0.001-inch graduations plus a movable vernier reading to 0.0001 inch.

The table surface and T-slots are all ground in place. A table movement of 6 inches is obtained with each turn of the 8-inch handwheel. Both permanent and electromagnetic clutches; swiveling and tilting vises; indexing centers and footstocks; radius and angular truing devices; and other attachments are available as extra equipment.

The roller-bearing reciprocating table has a work surface 6 by 18 inches, longitudinal hand feed of 18 inches, transverse feed of 6 inches, and a vertical feed of 12

inches under a 12-inch wheel. The roller-bearing saddle has a travel of 6 3/4 inches. The grinder requires a floor space 50 by 85 inches and weighs 1520 pounds.

For wet grinding, the machine is equipped as shown at the left in Fig. 2. The wet-grinding attachment consists of a large, specially constructed tank, a complete set of adjustable water guards on table, nozzle, hose, and pump.

For dry grinding, the machine can be furnished with Dustsnare equipment, shown at the right in Fig. 2. This is a filterless dust exhauster and separator that operates on both cyclone and vacuum principles. Easily installed in a small space, it separates down to 5 microns at a specific gravity of 1.5, processing 309 cubic feet of air per minute.

Circle Item 127 on postcard, page 261

### Bryant "Centalign" Automatic Internal Grinder

The Bryant Chucking Grinder Co., Springfield, Vt., has brought out an automatic internal grinding machine called "Centalign," which employs new principles of construction developed to provide greater rigidity and stability.

The work-head, wheel-head, and wheel-slide motions have been brought into a common plane, reducing deflections to a

minimum and insuring more accurate alignment. Vibration absorbers are incorporated in the fabricated bed to dampen all forces and assure fine finishes.

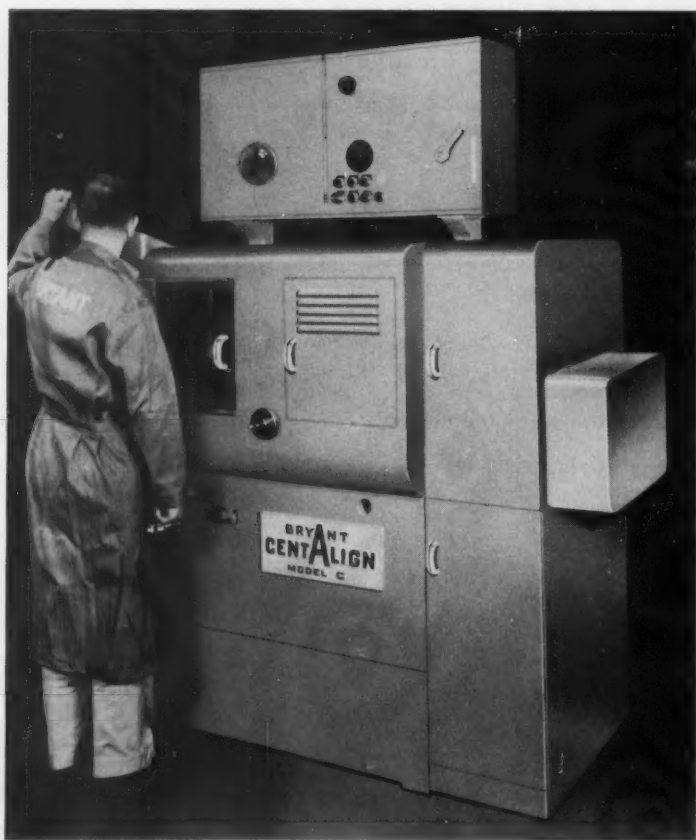
The "Centalign," with its 10-inch swing and 1-inch grinding stroke, is designed for long-run, high-production grinding of bearing raceways and taper bores, and for similar operations on various work parts. However, the control of machine functions by programming cam sets, which can be readily interchanged, makes certain types of recurring short-run operations feasible.

The total wheel-slide stroke is 8 inches and the grinding stroke length can be adjusted from 1/16 to 1 inch, either during operation or while the machine is at rest. Three-fourths of an inch of cross-feed motion is provided.

The grinder is equipped with Bryant new Series 800 wheel-heads and special high-frequency motors. The wheel-heads are cooled from the machine coolant supply system and are mist-lubricated. The work-head, which holds and rotates the work-piece, can be readily adjusted longitudinally for wheel-stroke position and swiveled for taper bore grinding.

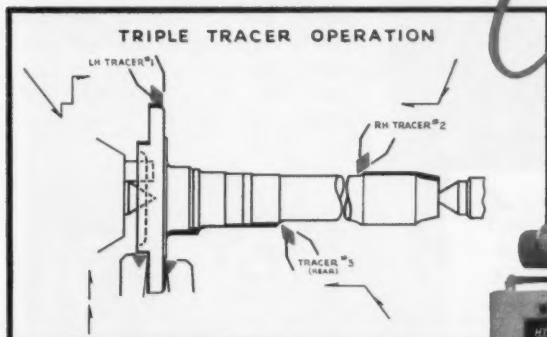
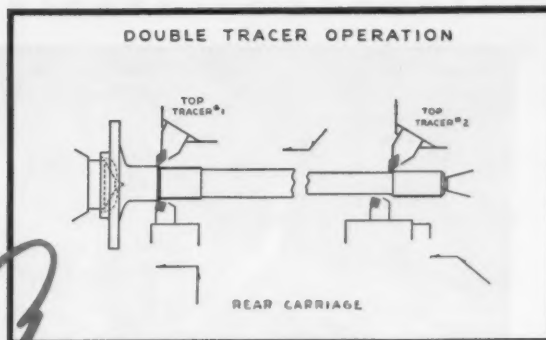
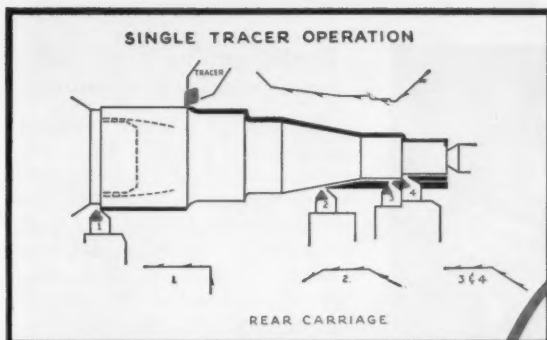
The machine is adapted to the use of shoe centerless fixtures, available in two standard types. The larger of these fixtures will hold work up to a maximum outside diameter of 4 inches and the smaller takes work with an outside diameter of 2 inches. The grinder weighs about 5280 pounds and, with guards open, requires a floor space 89 by 53 inches.

Circle Item 128 on postcard, page 261  
(This section continued on page 240)

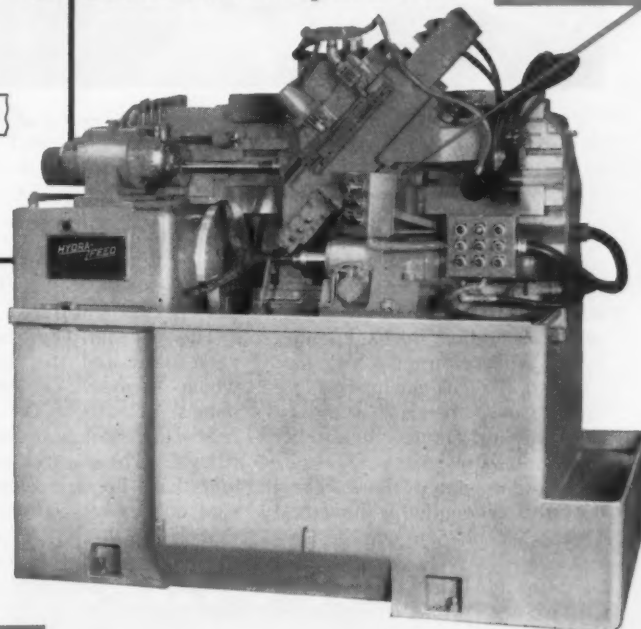


"Centalign" automatic internal grinder introduced by the Bryant Chucking Grinder Co.





*Another Hydra-Feed Exclusive*



## Single, Double, Triple, RH or LH Tracer Combinations

Rough and finish turn such parts as axle shafts, camshafts, stem pinions, etc., in one setup using the right combination of tracer and rear carriage tooling. Roughing is done with rear carriage tools and finishing with one, two or three tracers—either right or left hand. Three standard models, HDT-8, HDT-12 and HDT-16, enable you to get the best machine for the job.

Either one or two tracers are mounted on the distinctive Hydra-Feed pioneered top carriage—a production proved feature of Hydra-Feed machines since 1946. A third tracer, when required, is mounted on the rear carriage.

### With Hydra-Feed top-tracer lathes you also get:

- Quick changeover due to the unobstructed-front design.
- Location of tracers and templates above workpiece—dirt, chips and cutting oils can't interfere with accuracy or performance.
- Easy automation due to the open front design and the ability to pass work straight through the machine under the top carriage.
- Unmatched chip capacity with the oversize chip chute located below the entire work area. Chips can be removed automatically through the end, rear or bottom of the machine.

Ask for Bulletin HDT-55



## HYDRA-FEED MACHINE TOOL CORPORATION

SOUTH NORWALK, CONNECTICUT AND DETROIT (Ferndale), MICHIGAN

Address all inquiries to:

SALES AND ENGINEERING OFFICE, 730 W. EIGHT MILE ROAD, FERNDALE, MICHIGAN

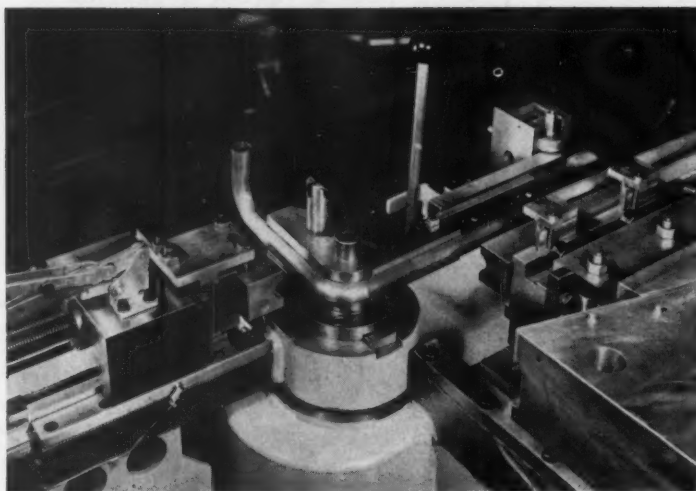


Fig. 1. Close-up view of bent tube and pressure dies of Wallace consensus tube bender

### Wallace Consensus Tube Bender

A Wallace 500, special aircraft, consensus type tube bender with wedge-action pressure dies has been built for the Lockheed Aircraft Corporation, Burbank, Calif., by the Wallace Supplies Mfg. Co., Chicago, Ill. This machine will be used to make bends in stainless-steel tubing employed for hydraulic lines.

A close-up view of the work and die just after completing the second bend in a one-eighth hard stainless-steel tube, having an outside diameter of 1 inch and a wall thickness of 0.028 inch, is shown in Fig. 1. In this operation, the tubing is bent to a center line radius of 1 1/2 inches. The illustration shows the pressure dies re-

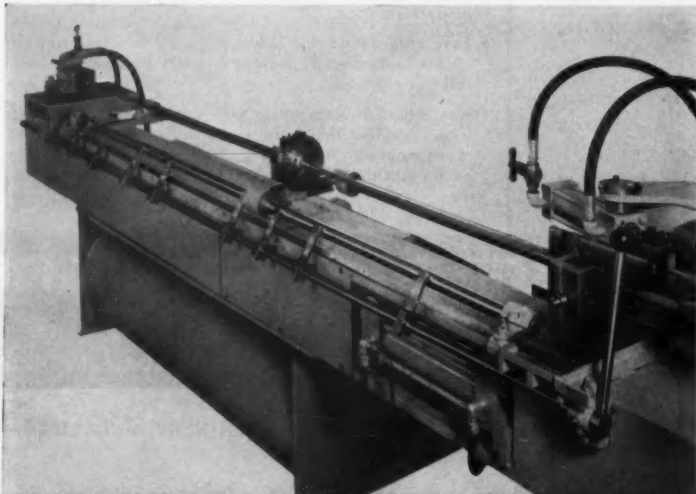
leased to permit removal of the work. Bends made with this equipment are said to be practically perfect and free of wrinkles.

The bar carrying the length-gage stops and the dial device which controls or selects the planes in which the different bends are made can be seen in Fig. 2. These work-controlling units have been developed to assure uniformly accurate work so that the finished tubes will be interchangeable, regardless of the number and angular positions of the bends.

Hydraulic controls for the machine have been made as simple and foolproof as possible.

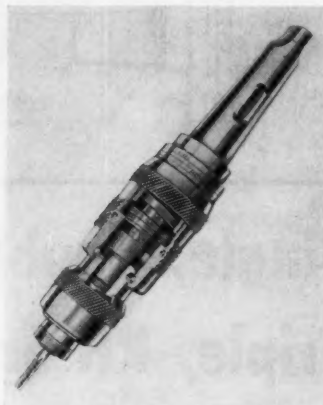
Circle Item 129 on postcard, page 261

Fig. 2. View of Wallace tube bender showing length-gage stops and dial type device for controlling planes of bends



### Davis Tapping Head with Automatic Torque Control

An adjustable-clutch tapping head, which provides automatic torque control for a broad range of working conditions, is announced by the Davis Boring Tool Division of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Known as the "Tap-Saver," this tapping head regulates driving torque automatically according to the hardness of material and type and size of tap used, provided the control dial has been set correctly. It is claimed that through this action, thread accu-



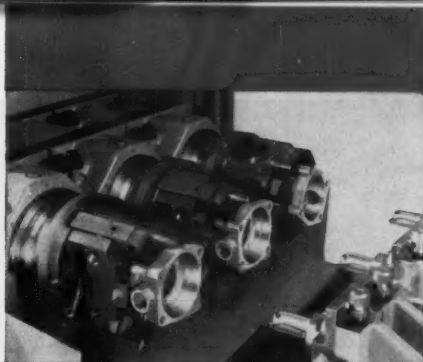
Davis automatic torque control tapping head

racy and finish are improved substantially, and output per tool is increased. Tap breakage is also said to be virtually eliminated.

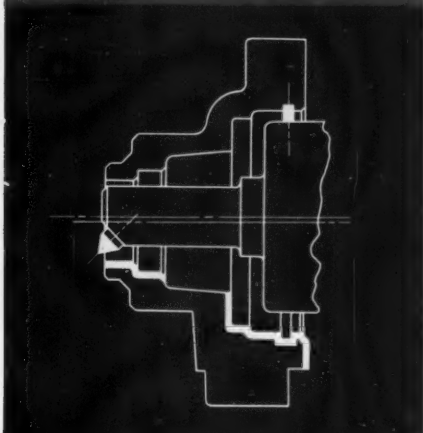
The "Tap-Saver" can be used effectively for drilling, reaming, spot-facing, and counterboring, in addition to right-hand or left-hand tapping. A quick-change chuck permits rapid tool changes.

The tapping head is available in three standard sizes to accommodate Morse taper shank drill collet Nos. 2, 3, and 4, respectively. Each head is supplied as part of a complete set which includes ten collets and a storage box. Each set has three drill collets of the proper size number and seven assorted tap collets for right- or left-hand taps. The three sizes take tap collets from 1/4 inch through 2 inches.

Circle Item 130 on postcard, page 261  
(This section continued on page 246)



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



Heavy lines denote surfaces machined. 12 operations are performed in one machine cycle.

**INTRICATE CONTOURING  
IS FAST, ACCURATE ON**

## *Ex-Cell-O's Cam Operated, Precision Boring Machine*

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with better accuracy, versatility, speed and flexibility in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change of operation. All motors are outside the base.

Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base.

Contact your Ex-Cell-O representative or write direct for complete information.

### **EX-CELL-O CORPORATION**

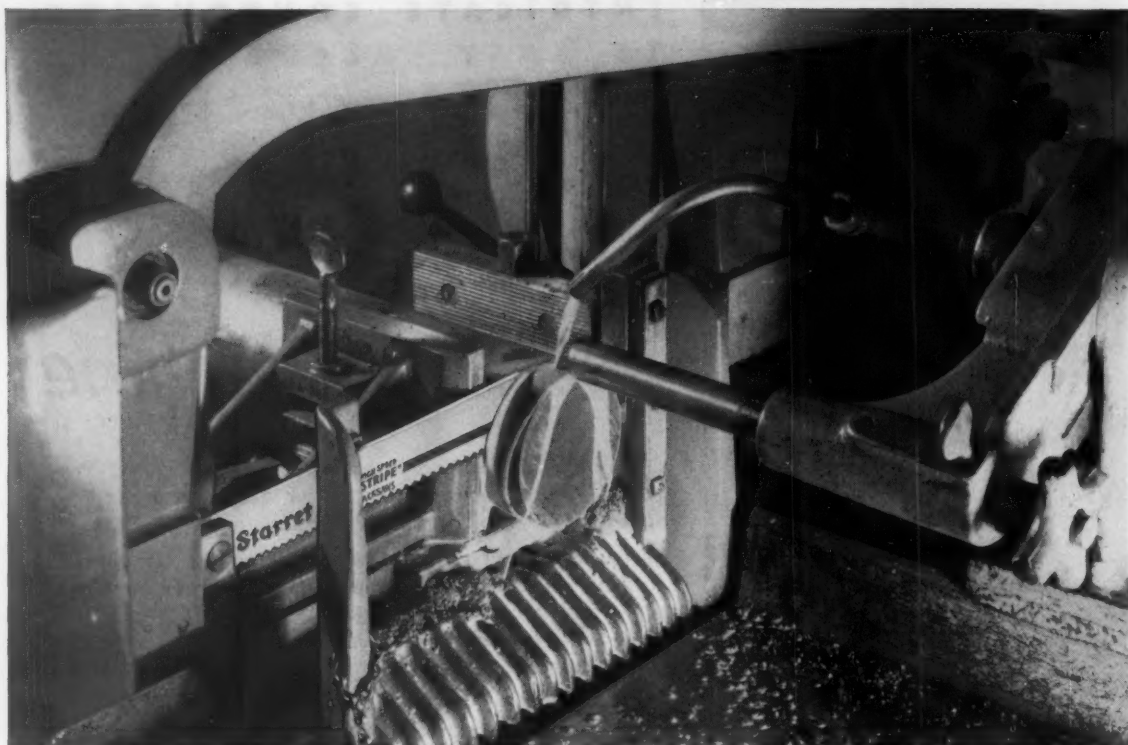
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES  
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS  
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-7



The Ex-Cell-O Style 312 Precision Boring Machine is operated by precision direct cam action. Because of the demand for this type of machine, a smaller model, the Ex-Cell-O Style 308, is now available.



## NEW STARRETT HACKSAW BLADES production-proved to cut faster, last longer

From the Metallurgical and Production Testing Laboratory of the "World's Greatest Toolmakers" come three new hacksaw blades — each with special characteristics for faster, easier cutting and longer blade life on a wide range of cutting assignments. To make it easy for you to select the right blade for any job, they are distinctively color-identified and have easy-to-remember names.

Starrett REDSTRIPE® SM Power and Hand Blades, the yellow blades with the distinctive red stripe, are specially tempered for cutting hard materials with heavier feeds, higher speeds.

Starrett GREENSTRIPE SAFE-FLEX® Welded Edge Power Blades are double welded, shatterproof, safer, straighter-cutting, longer-lasting. Especially recommended

for tough alloy steels, multiple cutting and interrupted cuts. Easily identified as the yellow blades with the green stripe. Hand blades also available.

Starrett BLUESTRIPE® High Speed Power and Hand Blades are specially heat treated for high speed production sawing of hard-to-cut metals — also recommended for general purpose cutting. Ask for the yellow blade with the distinctive blue stripe.

Starrett also makes a complete line of hole saws, band saws, and band knives — all available through your industrial distributor, a convenient and reliable source of supply. Ask him for the new Starrett Saw Catalog or write Dept. D, The L. S. Starrett Company, Athol, Mass., U. S. A.

# Starrett

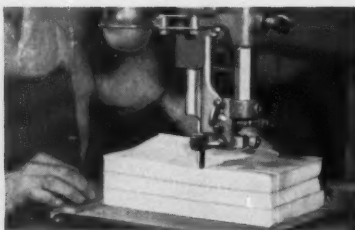
SINCE 1880  
WORLD'S GREATEST TOOLMAKERS



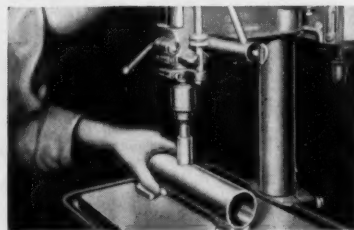
AND MEASURING TOOLS AND PRECISION INSTRUMENTS  
INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK  
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES



Use Starrett Production-Proved Band Saws for cutting metal, wood, plastics, etc.



Use Starrett Fast-Kut Band Knives for cutting soft or fibrous materials. 3 types, all sizes.

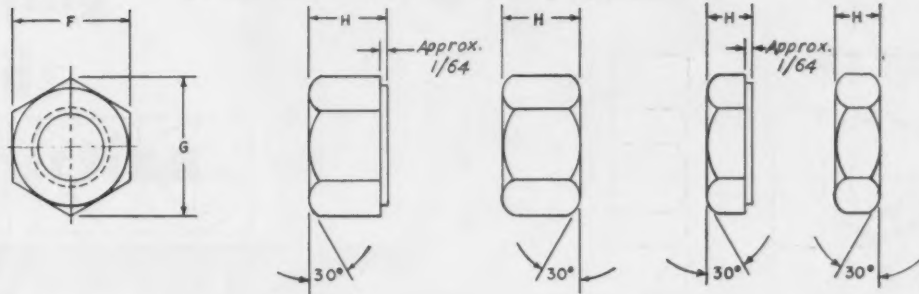


Use Starrett Safe-Flex High Speed Hole Saws for cutting clean, round holes in any material.



# MACHINERY'S DATA SHEET

## AMERICAN STANDARD HEAVY SEMIFINISHED HEXAGON AND HEXAGON-JAM NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F		Width Across Corners G		Thickness Heavy Nuts H			Thickness Heavy Jam Nuts H		
	Max. (Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.
1/4 0.2500	1/2 0.5000	0.488	0.577	0.556	15/64	0.250	0.218	11/64	0.188	0.156
5/16 0.3125	9/16 0.5625	0.546	0.650	0.622	19/64	0.314	0.280	13/64	0.220	0.186
3/8 0.3750	11/16 0.6875	0.669	0.794	0.763	23/64	0.377	0.341	15/64	0.252	0.216
7/16 0.4375	3/4 0.7500	0.728	0.866	0.830	27/64	0.441	0.403	17/64	0.285	0.247
<b>1/2 0.5000</b>	<b>7/8 0.8750</b>	<b>0.850</b>	<b>1.010</b>	<b>0.969</b>	<b>31/64</b>	<b>0.504</b>	<b>0.464</b>	<b>19/64</b>	<b>0.317</b>	<b>0.277</b>
9/16 0.5625	15/16 0.9375	0.909	1.083	1.037	35/64	0.568	0.526	21/64	0.349	0.307
5/8 0.6250	<b>1 1/16 1.0625</b>	<b>1.031</b>	<b>1.227</b>	<b>1.173</b>	<b>39/64</b>	<b>0.631</b>	<b>0.587</b>	<b>23/64</b>	<b>0.381</b>	<b>0.337</b>
3/4 0.7500	<b>1 1/4 1.2500</b>	<b>1.212</b>	<b>1.443</b>	<b>1.382</b>	<b>47/64</b>	<b>0.758</b>	<b>0.710</b>	<b>27/64</b>	<b>0.446</b>	<b>0.398</b>
7/8 0.8750	<b>1 7/16 1.4375</b>	<b>1.394</b>	<b>1.660</b>	<b>1.589</b>	<b>55/64</b>	<b>0.885</b>	<b>0.833</b>	<b>31/64</b>	<b>0.510</b>	<b>0.458</b>
<b>1 1.0000</b>	<b>1 5/8 1.6250</b>	<b>1.575</b>	<b>1.876</b>	<b>1.796</b>	<b>63/64</b>	<b>1.012</b>	<b>0.956</b>	<b>35/64</b>	<b>0.575</b>	<b>0.519</b>
1 1/8 1.1250	1 13/16 1.8125	1.756	2.093	2.002	1 7/64	1.139	1.079	39/64	0.639	0.579
1 1/4 1.2500	2 2.0000	1.938	2.309	2.209	1 7/32	1.251	1.187	23/32	0.751	0.687
1 3/8 1.3750	2 3/16 2.1875	2.119	2.526	2.416	1 11/32	1.378	1.310	25/32	0.815	0.747
<b>1 1/2 1.5000</b>	<b>2 3/8 2.3750</b>	<b>2.300</b>	<b>2.742</b>	<b>2.622</b>	<b>1 15/32</b>	<b>1.505</b>	<b>1.433</b>	<b>27/32</b>	<b>0.830</b>	<b>0.808</b>
1 5/8 1.6250	2 9/16 2.5625	2.481	2.959	2.828	1 19/32	1.632	1.556	29/32	0.944	0.868
<b>1 3/4 1.7500</b>	<b>2 3/4 2.7500</b>	<b>2.662</b>	<b>3.175</b>	<b>3.035</b>	<b>1 23/32</b>	<b>1.759</b>	<b>1.679</b>	<b>31/32</b>	<b>1.009</b>	<b>0.929</b>
1 7/8 1.8750	2 15/16 2.9375	2.844	3.392	3.242	1 27/32	1.886	1.802	1 1/32	1.073	0.989
<b>2 2.0000</b>	<b>3 1/8 3.1250</b>	<b>3.025</b>	<b>3.608</b>	<b>3.449</b>	<b>1 31/32</b>	<b>2.013</b>	<b>1.925</b>	<b>1 3/32</b>	<b>1.138</b>	<b>1.050</b>
2 1/4 2.2500	3 1/2 3.5000	3.388	4.041	3.862	2 13/64	2.251	2.155	1 13/64	1.251	1.155
2 1/2 2.5000	3 7/8 3.8750	3.750	4.474	4.275	2 29/64	2.505	2.401	1 29/64	1.505	1.401
2 3/4 2.7500	4 1/4 4.2500	4.112	4.907	4.688	2 45/64	2.759	2.647	1 37/64	1.634	1.522
<b>3 3.0000</b>	<b>4 5/8 4.6250</b>	<b>4.475</b>	<b>5.340</b>	<b>5.102</b>	<b>2 61/64</b>	<b>3.013</b>	<b>2.893</b>	<b>1 45/64</b>	<b>1.763</b>	<b>1.643</b>
3 1/4 3.2500	5 5.0000	4.838	5.774	5.515	3 3/16	3.252	3.124	1 13/16	1.876	1.748
3 1/2 3.5000	5 3/8 5.3750	5.200	6.207	5.928	3 7/16	3.506	3.370	1 15/16	2.006	1.870
<b>3 3/4 3.7500</b>	<b>5 3/4 5.7500</b>	<b>5.562</b>	<b>6.640</b>	<b>6.341</b>	<b>3 11/16</b>	<b>3.760</b>	<b>3.616</b>	<b>2 1/16</b>	<b>2.134</b>	<b>1.990</b>
4 4.0000	6 1/8 6.1250	5.925	7.073	6.755	3 15/16	4.014	3.862	2 3/16	2.264	2.112

All dimensions given in inches.

**BOLD TYPE** indicates products unified dimensionally with British and Canadian Standards.

Semifinished nuts are finished on bearing surface and threaded. Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of

thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

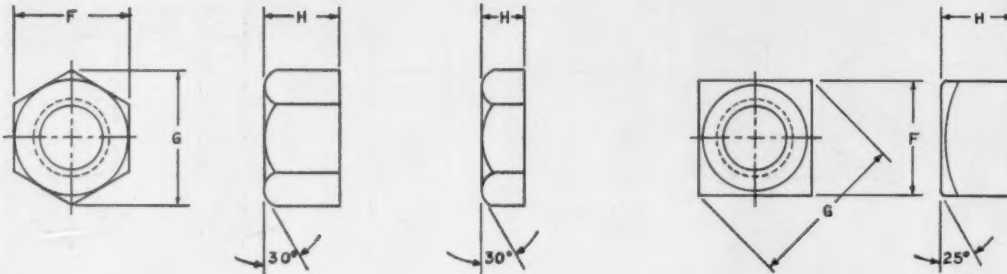
Thread may be coarse, fine, or 8-thread series; Class 2B tolerance; unless otherwise specified, coarse-thread series will be furnished.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 39 W. 39th St., New York 18, N. Y.

# MACHINERY'S DATA SHEET

## AMERICAN STANDARD HEAVY SQUARE, HEXAGON, AND HEXAGON-JAM NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F		Width Across Corners G				Thickness Heavy Nuts H			Thickness Heavy Jam Nuts H		
	Max. (Basic)	Min.	Square		Hex.		Nom.	Max.	Min.	Nom.	Max.	Min.
1/4 0.2500	1/2 0.5000	0.488	0.707	0.670	0.577	0.556	1/4 0.266	0.218		3/16 0.204	0.156	
5/16 0.3125	9/16 0.5625	0.546	0.795	0.750	0.650	0.622	5/16 0.330	0.280		7/32 0.236	0.186	
3/8 0.3750	11/16 0.6875	0.669	0.973	0.919	0.794	0.763	3/8 0.393	0.341		1/4 0.268	0.216	
7/16 0.4375	3/4 0.7500	0.728	1.060	1.000	0.866	0.830	7/16 0.456	0.403		9/32 0.300	0.247	
1/2 0.5000	7/8 0.8750	0.850	1.237	1.167	1.010	0.969	1/2 0.520	0.464		5/16 0.332	0.277	
5/8 0.6250	1 1/16 1.0625	1.031	1.503	1.416	1.227	1.175	5/8 0.647	0.587		3/8 0.397	0.337	
3/4 0.7500	1 1/4 1.2500	1.212	1.768	1.665	1.443	1.382	3/4 0.774	0.710		7/16 0.462	0.398	
7/8 0.8750	1 7/16 1.4375	1.394	2.033	1.914	1.660	1.589	7/8 0.901	0.833		1/2 0.526	0.458	
1 1.0000	1 5/8 1.6250	1.575	2.298	2.162	1.876	1.796	1 1.028	0.956		9/16 0.590	0.519	
1 1/8 1.1250	1 13/16 1.8125	1.756	2.563	2.411	2.093	2.002	1 1/8 1.155	1.079		5/8 0.655	0.579	
1 1/4 1.2500	2 2.0000	1.938	2.828	2.661	2.309	2.209	1 1/4 1.282	1.187		3/4 0.782	0.687	
1 3/8 1.3750	2 3/16 2.1875	2.119	3.094	2.909	2.526	2.416	1 3/8 1.409	1.310		13/16 0.846	0.747	
1 1/2 1.5000	2 3/8 2.3750	2.300	3.359	3.158	2.742	2.622	1 1/2 1.536	1.433		7/8 0.911	0.808	
1 3/4 1.7500	2 3/4 2.7500	2.662			3.175	3.035	1 3/4 1.790	1.679	1	1.040	0.929	
2 2.0000	3 1/8 3.1250	3.025	Sizes Not Standard	Sizes Not Standard	3.608	3.449	2 2.044	1.925	1	1/8 1.169	1.050	
2 1/4 2.2500	3 1/2 3.5000	3.388			4.041	3.862	2 1/4 2.298	2.155	1	1/4 1.298	1.155	
2 1/2 2.5000	3 7/8 3.8750	3.750			4.474	4.275	2 1/2 2.552	2.401	1	1/2 1.552	1.401	
2 3/4 2.7500	4 1/4 4.2500	4.112			4.907	4.688	2 3/4 2.806	2.647	1	5/8 1.681	1.522	
3 3.0000	4 5/8 4.6250	4.475			5.340	5.102	3 3.060	2.893	1	3/4 1.810	1.643	
3 1/4 3.2500	5 5.0000	4.838			5.774	5.515	3 1/4 3.314	3.124	1	7/8 1.939	1.748	
3 1/2 3.5000	5 3/8 5.3750	5.200			6.207	5.928	3 1/2 3.568	3.370	2	2.068	1.870	
3 3/4 3.7500	5 3/4 5.7500	5.562			6.640	6.341	3 3/4 3.822	3.616	2	1/8 2.197	1.990	
4 4.0000	6 1/8 6.1250	5.925			7.073	6.755	4 4.076	3.862	2	1/4 2.326	2.112	

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian Standards.

Nuts are not finished on any surface but are threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered or (except jam nuts) washer-crowned. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be at right angles to the axis of the

threaded hole within a tolerance of 3 degrees for 1-inch nuts or smaller, and 2 degrees for nuts larger than 1 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

Thread shall be coarse-thread series, Class 2B tolerance.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by the manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# Automatic Handling Speeds Production

## On a Standard Ex-Cell-O Precision Boring Machine

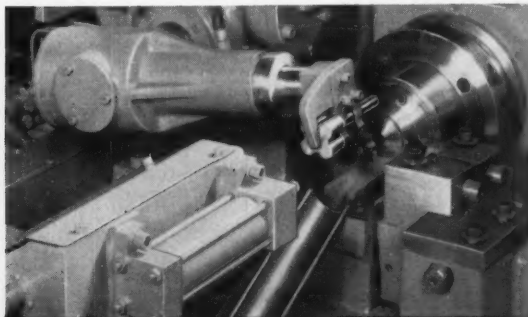
### For a Fraction of Special Machine Cost

This standard Ex-Cell-O Precision Boring Machine is equipped for facing both ends of oil pump impellers. With automatic work handling equipment it operates at a net production rate of 156 pieces per hour. The use of a standard machine keeps the original cost at a minimum.

In a completely automatic cycle a loading arm

picks a part from a chute and loads it into the chuck, then the parts are clamped, machined and ejected.

The flexibility of standard Ex-Cell-O Machines permits low cost automated operation with the addition of work handling equipment. Such a machine may be profitable in your plant. Wire or write Ex-Cell-O in Detroit.

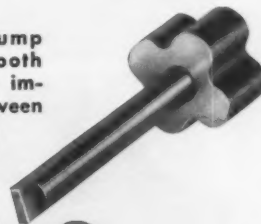


The loading arm is about to load the part into the chuck. After machining, part is ejected into chute in foreground.



Ex-Cell-O Style 2112-B Precision Boring Machine equipped with a single work spindle and special work handling devices for automatic loading, machining and ejecting.

In straddle facing oil pump impellers (at right) smooth machine performance is imperative. Width limits between faces are held to .0005".

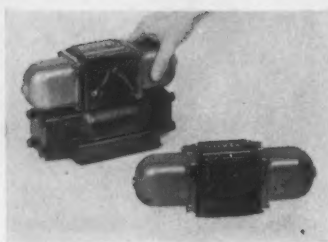


## EX-CELL-O

CORPORATION  
DETROIT 32, MICHIGAN



MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



### Vickers Solenoid-Controlled Directional Valves

Improved solenoid-operated and solenoid-controlled, pilot-actuated directional valves for industrial oil-hydraulic systems available from Vickers, Incorporated, Detroit, Mich. Ample room is provided in the bodies of these valves for making electrical connections, thereby eliminating the need for a separate conduit box. The DG-5 model, shown at the left, is solenoid-controlled and pilot-operated. The DG-4 model, shown at the right, is solenoid-operated. The valves are available in a variety of modifications to meet a wide range of control requirements.

Circle Item 131 on postcard, page 261

### Air-Operated Collet Fixture

Air-operated collet fixture designed to simplify secondary operations on parts that can be chucked in a standard 5-C collet having a maximum capacity for work up to 1 inch in diameter. Larger step collets can be used for special applications. Known as the "Air-Pal," the collet provides positive, two-way holding power with a 750-pound pull at an air-operating pressure of 100 pounds per square inch. The fixture is precision-built, of light-

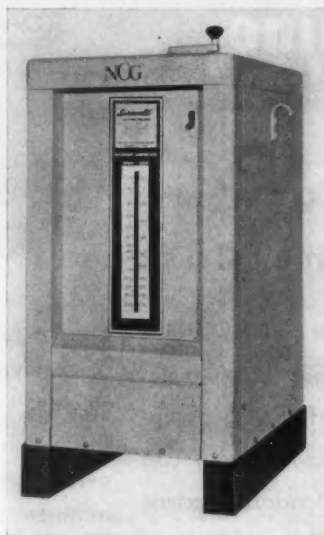


weight materials, and of non-corrosive interior construction. Weight with collet is 4 pounds. The unit is 3 1/2 inches high, 4 inches wide, and 6 1/2 inches long. It is manufactured by the Beckett-Harcum Co., Wilmington, Ohio.

Circle Item 132 on postcard, page 261

### Improved Arc Welder

"Sureweld" arc welder of improved line announced by the National Cylinder Gas Co., Chicago, Ill. This line comprises ten different type welders and ninety-eight models. It includes alternating-current welders, direct-current rectifier welders, alternating-current inert arc welders, combination alternating- and direct-current welders, and portable



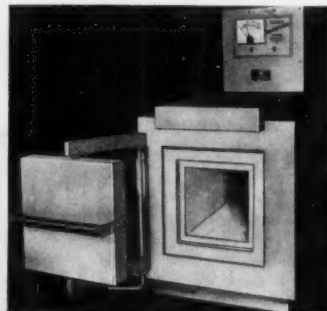
engine-driven direct-current welders. Capacities range from 200 amperes, 30-volt direct current to 600 amperes, 30-volt alternating current.

Circle Item 133 on postcard, page 261

### High-Temperature Electric Furnace

High-temperature electric furnace featuring a safety-swing insulated door for operator protection is announced by Auto-Control Laboratories, Culver City, Calif. This

furnace, designated "Thermocal," is adapted for heat-treating tools and dies for machine shops, maintenance, and repair facilities, glass heat-treating, metallurgical and testing laboratories, and ceramic kilns. Other uses include hardening high-speed steel, annealing, drawing, tempering, stress relieving, silver soldering, or any

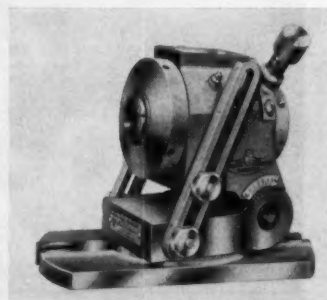


type of work requiring high temperatures. Available in six models with inside dimensions ranging from 4 by 4 by 4 inches to 8 1/2 by 8 1/2 by 17 inches. All models operate up to 2300 degrees F. intermittent service and 2200 degrees F. continuous service temperature.

Circle Item 134 on postcard, page 261

### Kuma Universal Dividing Collet Head

Redesigned, universal dividing collet head announced by Kuma Tool Co., Chicago, Ill. This collet head has been developed to permit fast, accurate indexing for milling and grinding parts. The conventional dividing-head indexing plate containing several hundred holes has been replaced by





FOUND WHERE FINE BUSINESS MACHINES ARE "BORN"

## GRAND RAPIDS GRINDERS



### INTERNATIONAL BUSINESS MACHINES

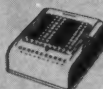
Producing an intricate business machine requires exceptional toolroom precision. That's why these manufacturers use Grand Rapids Grinders . . . engineered to achieve extraordinary grinding precision at cost-cutting speed.

Model No. 55, at right, offers such features as one-piece column and base for permanent, vibrationless alignment, wheel head with powered rapid vertical travel, hydraulically actuated cross feed and longitudinal travel table. And it's the fastest grinder of its size and type, with a variable table speed up to 125 fpm!

Whether you make business machines or bulldozers, you can count on Grand Rapids Grinders for maximum toolroom precision.



SMITH-CORONA



COMPTOMETER



REMINGTON RAND



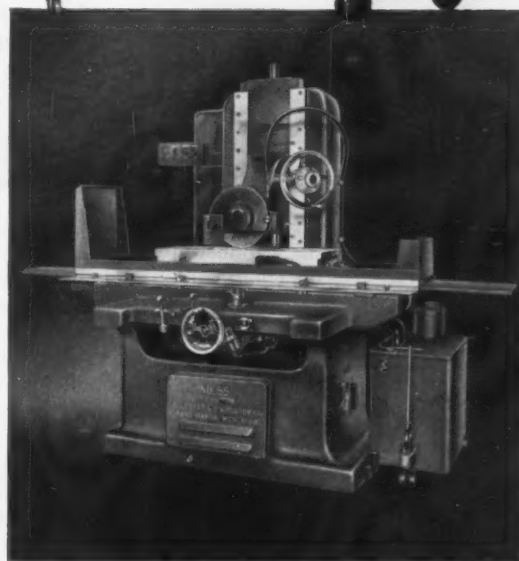
UNDERWOOD



R. C. ALLEN



**GALLMEYER & LIVINGSTON COMPANY**



GRAND RAPIDS No. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

A note on your letterhead will bring complete details.



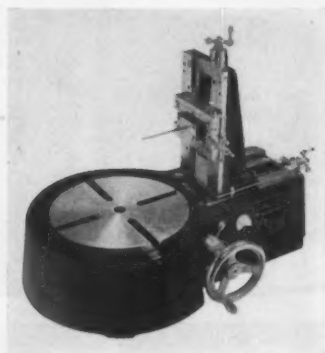
305 Straight Ave., S.W., Grand Rapids, Michigan

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—247

interchangeable index-plates available in a range of 2 to 36 spaces, permitting highly efficient operation and reducing the opportunity for human error. The head can be swiveled 360 degrees on the base and elevated from zero to 90 degrees. Concentricity of collet sleeve bore is 0.0002 inch. Equipment includes a radius wheel-dressing attachment, angle wheel-dressing attachment, quick-action collet closer, and chuck adapter.

Circle Item 135 on postcard, page 261



### Summit-Roberts Contour-Measuring Instrument

"Contour-O-Scope" designed for quick, accurate checking and inspecting of contoured surfaces announced by Summit-Roberts Products, Inc., Toledo, Ohio. This instrument checks dimensional radial accuracy of parts such as impellers, expellers, inducers, exducers, defusers, nozzles, turbine wheels, blades, two- and three-dimensional cams, and many other parts having contoured surfaces.

Circle Item 136 on postcard, page 261

### High-Pressure Control Valve

Multi-directional, sectional, hydraulic control valve of line developed for continuous duty at pressures as high as 2000 pounds per square inch by the Commercial Shearing & Stamping Co., Youngstown, Ohio. A major feature of these valves is a positive "no load-drop," non-constricting check in each operating action

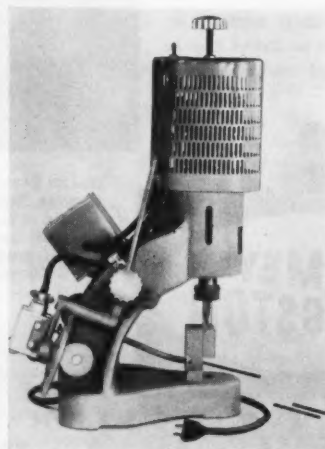


section. Other features include greatly reduced resistance to flow through internal passages, sealing by O-rings instead of gaskets, and a unique cartridge type relief valve. The valves are available with 1/2-, 3/4-, or 1-inch ports, with nominal capacities of 20, 35, or 60 gallons per minute, respectively.

Circle Item 137 on postcard, page 261

### Automatic Cut-Off Machine

All-electric automatic cut-off machine named "Electrocut" introduced by Black & Webster, Inc., Newton, Mass. This machine is designed to rapidly and economically cut bare and insulated wire, spaghetti tubing, plastic tubing, and similar materials to predetermined lengths. It is capable of handling materials up to 3/8 inch in diameter and can be adjusted to cut lengths ranging from 3/4 inch

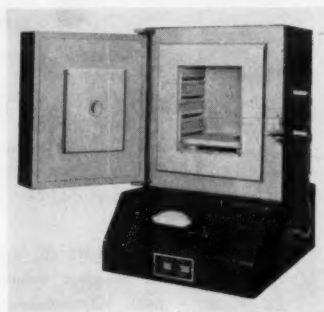


up to 13 inches. The material to be cut is drawn directly from the spool by the machine, which stops automatically when the spool is empty. Power is obtained by plugging into any 115-volt, 60-cycle, single-phase electrical outlet.

Circle Item 138 on postcard, page 261

### Small Laboratory Furnace

"Dyna-Trol" furnace designed for research laboratory and small heat-treating applications by the L & L Mfg. Co., Upland, Pa. The time required to attain a temperature of 2000 degrees F. is one hour, and 2300 degrees F., one and one-half hours. The temperature range is from 300 to 2000 degrees F. in one series, and 400 to 2300 degrees F. in another. Some of these furnaces operate on 110 volts. The sizes are: 4 1/2 inches wide by 4 1/2 inches high by 6 inches deep in the P46 and



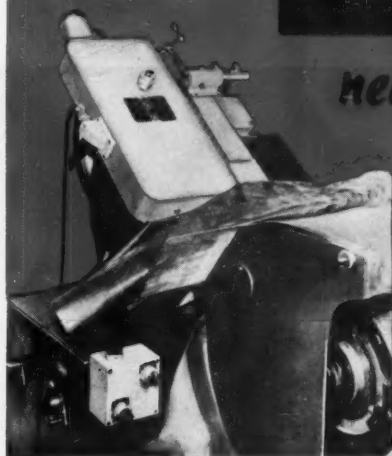
P46H models, and 6 inches wide by 6 inches high by 6 inches deep in the P76 and P76H models. Interior dimensions of other models are up to 6 by 6 by 18 inches. The temperature may be held at any desired level within the range of the furnace by means of input controllers. These controllers may be set at from 7 to 100 per cent of the input value. Zone gradient control is obtained by the use of multiple circuits, each with its own input controller. Gradients are indicated by a pyrometer, two thermo-couples, and a thermo-couple selector switch. The elements are supported by means of specially designed holders having excellent heat transfer properties.

Circle Item 139 on postcard, page 261

*Now*

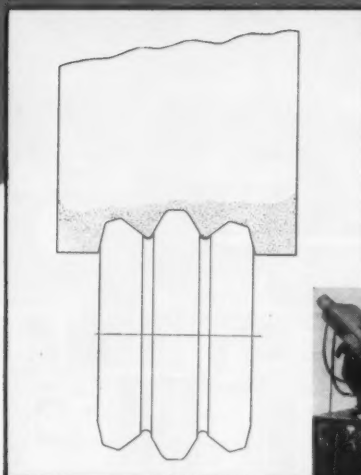
# GRINDING WHEEL PROFILES

*never before possible*



*with the new*  
**HOG LUND**  
*Model 83*  
**WHEEL DRESSER**

THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES



**ON  
CENTERLESS  
GRINDERS**



Now, with Model 83, any complex contour can be formed on the grinding wheel, limited only by the size and shape of the Diamond. If the Diamond can enter into the profile, the profile can be dressed—in fact, any contour desired can be continuously and accurately dressed in one automatic cycle! Instead of single template bars, Model 83 uses a pair of enlarged synchronized templates to obtain the most complex contours. Model 83 insures absolutely UNIFORM peripheral contour movements—giving profiles heretofore considered impossible on centerless grinders. Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the HOG LUND way of practically eliminating skill in production contour grinding.



**HOG LUND**

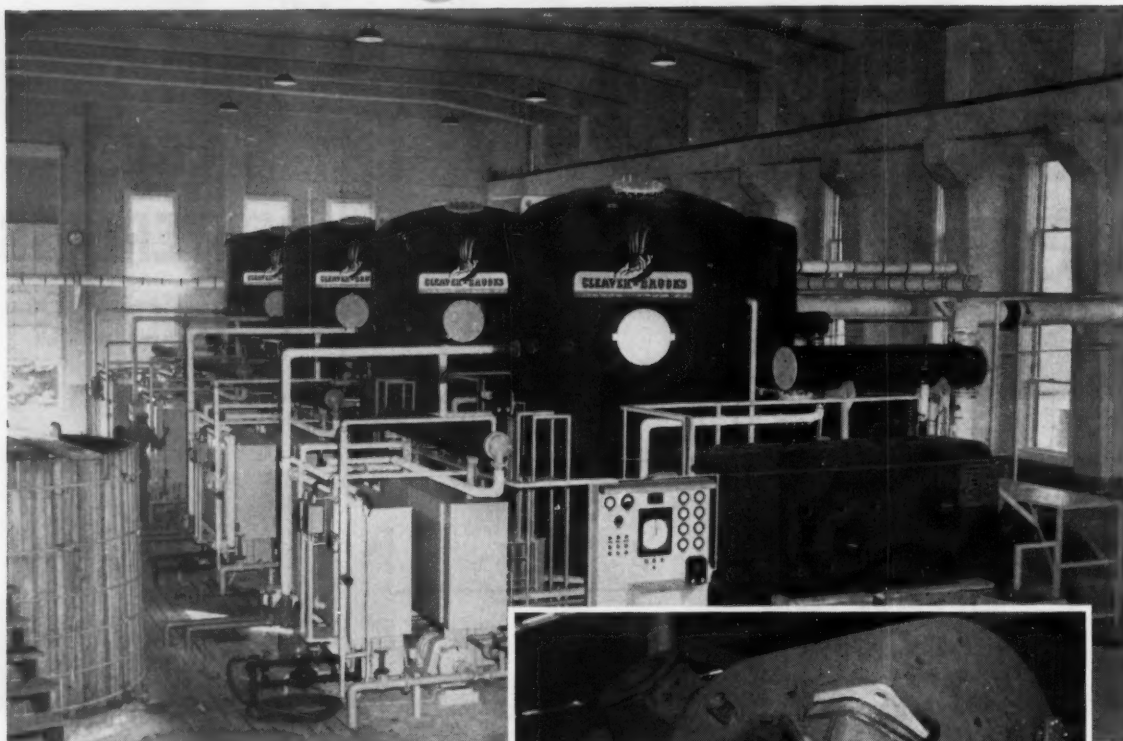
ENGINEERING & MANUFACTURING CO.

341 Snyder Ave., Berkley Heights, N. J.

## Check these features of HOG LUND Wheel DRESSERS

- Precision
- Automaticity
- Will dress any angle on the grinding wheel, perpendicular as well as horizontal.
- Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle (can even undercut grinding wheels, if necessary).
- Eliminates necessity of skill in contour grinding.
- Set up time negligible. No skill required.
- Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.
- Uniform peripheral dressing speed of diamond.

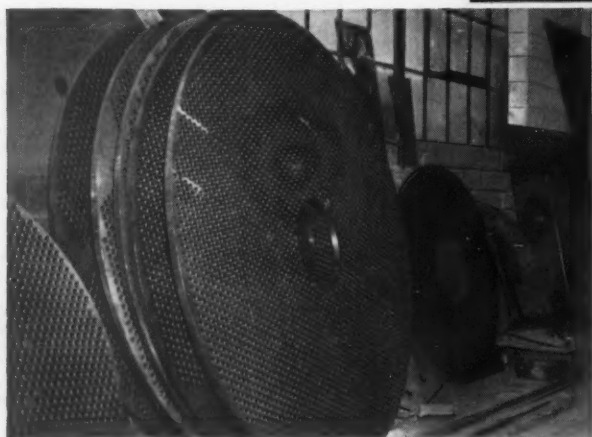
# World's



**BATTERY OF CLEAVER-BROOKS EVAPORATORS IN ACTION**—Revere Silicon Bronze was chosen for these evaporators and their component parts because of its high corrosion resistance and non-contamination properties, great strength and weldability. All of the components, as well as the 4 evaporator shells, are made of Revere Silicon Bronze Alloy No. 420.



**ONE OF THE 4 EVAPORATOR SHELLS** made of Revere Silicon Bronze, fabricated and installed by CLEAVER-BROOKS MFG. CORP., Waukesha, Wisconsin.



**EIGHT TUBE SHEETS LIKE THESE** were used in the Bermuda installation . . . 2 per evaporator. Each tube sheet, made of Revere Silicon Bronze, is 86" in diameter, 1 $\frac{1}{4}$ " thick and weighed approximately 1,360 lbs. after drilling.



# Largest

## VAPOR-COMPRESSION SEA WATER DISTILLATION PLANT

*Made and installed by* **CLEAVER-BROOKS**

*... Vital distillation units fabricated from*  
**REVERE SILICON BRONZE**

This plant installed at the Kindley Air Force Base in Bermuda has a total daily capacity of 200,000 gallons and eliminates the dependence of the Base on rainfall or shipment of water by tankers.

Distilled water is produced in the ratio of 300 lbs. to each pound of Diesel fuel. Total costs are estimated at \$1.25 per thousand gallons of distilled water. Nearly every component part made by Cleaver-Brooks is about twice the size of its largest previous counterpart. For example, the evaporators are 16½ feet high. Each, with its component parts, weighs approximately 40,000 lbs., the empty Revere Silicon Bronze shell alone accounting for 28,000 lbs.

There is an interesting story behind the development and manufacture of this equipment. The four huge pressure vessels had to be fabricated of Revere Silicon Bronze Alloy No. 420. Knowing Revere's wide experience in welding copper-base alloys, Cleaver-Brooks called in a Technical Advisor, and gave him a complete set of blue-

prints of the vessels, with a request for suggestions regarding joint design and welding techniques. He in turn consulted the Welding Section of the Revere Research Department. Their recommendations were adopted, and the customer reported that the original estimate of welding time had been cut considerably, reducing production costs correspondingly.

The Revere Technical Advisory Service is glad to collaborate on problems involving the specification and fabrication of copper and copper-base alloys, and aluminum alloys. See the nearest Revere Sales Office.

### **REVERE COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.



THE STEAM SEPARATORS are identified by their conical tops and directional vanes. They are of the cyclone type, which is a patented feature of CLEAVER-BROOKS evaporators, and remove entrained water from the steam, thus preventing contamination of the fresh water coming from this unit. The result is an extremely high purity of the fresh water product.

The rectangular objects at rear of photograph are the "Downcomers" which bring water down from the top of the steam separator. The tubes in left foreground are "Hotwells," which receive the distilled water discharge from the evaporator shell.



# Between Grinds

By E. S. Salichs

## A Hat Trick

A commercial pilot who recently retired with the record of the most flying time in the United States was about to play tennis (and why not) with a pretty young blonde (and why not). They both wore tennis hats, he to protect his very bald head, she her very fair skin. As she fastened her hat on her hair with bobby pins, she asked the pilot in wonderment how he kept his hat on. "I suppose you'd call it 'stressed skin,'" he answered, "but you wouldn't know anything about that."

## Cool Colonial

A student of Maryland's historic mansions analyzed their interior coolness on hot, humid days as early air conditioning, achieved in

this manner: Interior facings of the houses were made of salmon colored bricks. Sawdust was mixed with the clay, and the sawdust was burned out during the firing, leaving porous salmon bricks that absorbed moisture. The source of this information was *Miniaturesque* (published by Miniature Precision Bearings, Inc.), which suggested that our ancestors enjoyed some of our modern conveniences under other names.

## Through a Medal Shop

The producer of T.V.'s "Let's Take a Trip" (a one-half-hour program sponsored by Columbia Broadcasting) telephoned our Editor asking him to suggest a machine shop from which a program could be worked up of interest to teenagers. After some thought, the

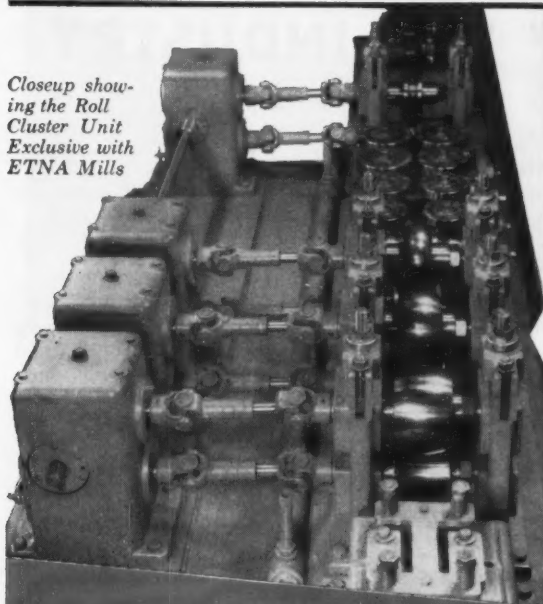
Editor proposed the Medallic Art Co. of New York City, which makes commemorative medals. So on May 6th, the entire process of developing a medal was televised, beginning with the artist's final drawing from a series of sketches. The plaster mold was formed and a bronze replica produced by electrolytic action. Then a mold was made on a greatly reduced scale from the master and finished by grinding. Finally, with the mold set up on a 1000-ton press, the television screen showed how medals were actually coined. After some finishing operations, including sand-blasting and plastic coating, sample medals were presented to two absorbed spectators—a boy and a girl—who may some day receive one in earnest. The Editor received a similar medal with his name engraved on the back.



**VIVACIOUS VALVES**—Ross Operating Valve Co. had fun introducing its Comet II multi-purpose valve at the recent ASTE Show. R. J. Cameron, president of the firm (seen here pointing absentmindedly to the cocktail glass), had the valve coupled with a tube arrangement in order to dispense Manhattans and Martinis to visitors in the Ross reception room. True, not all ASTE visitors were as attractive as Marion McGraw (ASTE staff member), but, yes, they were all as receptive.

**LEADING THE INDUSTRY IN DESIGN...**

*Closeup showing the Roll Cluster Unit Exclusive with ETNA Mills*



**NO MARKING ... NO SCRATCHING**

**NO UPSET EDGES ...**

THE ***Etna*** METHOD

**FOR SMOOTH, WELL FORMED  
STEEL TUBING**



Exclusive with Etna is the cluster unit. This unit progressively rolls the tube into shape without excessive stretching of the edges, thereby eliminating the "buckling" experienced with ordinary tube mills. Etna machines are not forming mills, they are designed for one purpose only ... to make clear, well formed carbon and stainless steel tubing with no marking, no scratching, no upset edges. Write for complete details.



*The ETNA 4KU Mill*

*Abbey* **ETNA** *Company*  
**3422 MAPLEWOOD AVE., TOLEDO 10, OHIO**

# News OF THE INDUSTRY

## California

**SPEED - D - BURR CORPORATION**, Glendale, Calif., has acquired property for construction of a plant costing more than \$250,000 located near Lomita and South Main in Los Angeles, Calif. This will more than triple present manufacturing facilities.

**GARRETT SUPPLY CO.**, Los Angeles, Calif., a division of the Garrett Corporation, announces an extension of its service in the heavy power transmission equipment field by becoming an authorized distributor for **CHAIN BELT CO.** products.

**LINDEN G. CRIDDLE** was appointed manager of Special Products Division, Consolidated Electrodynamics Corporation, Pasadena, Calif.

**AXELSON SALES CO.**, 2499 Huntington Drive, San Marino, Calif., a newly formed machinery sales concern, is owned and operated by **JACK L. AXELSON** and **DELBERT F. AXELSON**.

## Illinois

**JOSEPH T. RYERSON & SON, INC.**, Chicago, Ill., announces that its division of industrial engineering will hereafter be known as the plant engineering division. Its division of standards and methods has been renamed the operating controls division. **HERBERT G. DENT**, former manager of the industrial engineering division, is appointed director of the plant engineering division. Continuing on his staff are **ROLAND E. WALLIN** and **FRED W. PETTERS**. **GEORGE M. HARDING**, former head of the division of standards and methods, is appointed director of the operating controls division.

**WHEELCO INSTRUMENTS DIVISION OF BARBER-COLMAN CO.**, Rockford, Ill., announces the appointment of **INSTRUMENTS, INC.**, 122 N. Madison, P. O. Box 556, Tulsa, Okla., as representative for the sale of Wheelco industrial instruments and combustion safeguards in the Tulsa area. The Seattle branch offices of the

Wheelco Instruments Division have been moved to new quarters. They are now located at Room 206, Administration Bldg., Boeing Field, Seattle 8, Wash. The Wheelco branch office, formerly located in Clinton, Conn., has moved to 27 Wallace Ave., Wallingford, Conn.

**ILLINOIS TOOL WORKS**, Chicago, Ill., announces the following appointments: **HOLLIS H. MOSHER** has been named sales representative for the state of Ohio by the company's Tool & Machine Division. Mr. Mosher will maintain an office at 6848 Stewart Road, Kenwood Section, Cincinnati 36, Ohio. **CHARLES W. EDMONDSON** has been named sales manager of the eastern district by the company's Shakeproof Division.

**ONSRUD MACHINE WORKS, INC.**, Niles, Ill., announces the following appointments: **ALBERT L. BREUER**, vice-president in charge of machine tool sales; **ROBERT M. MILLER**, vice-president in charge of woodworking machinery sales; **EARL PANKONIN**, vice-president in charge of engineering; and **JOHN F. ANDREWS**, comptroller.

**JACK R. DeBACHER** has been elected vice-president of the Thor



Jack R. DeBacher, vice-president, Thor Power Tool Co.

**Power Tool Co.**, Aurora, Ill. Mr. DeBacher's activities will encompass every phase of the company's business of centralization of all Thor manufacturing, sales, and engineering divisions. Mr. DeBacher has been executive vice-president of the company's SpeedWay Manufacturing Division at Cicero since 1955 and was formerly vice-president of sales. He joined SpeedWay in 1939.

## Michigan

**H. L. TIGGES** has been appointed consulting sales engineer for the **BUHR MACHINE TOOL CO.**, Ann Arbor, Mich. Mr. Tigges formerly maintained his own consulting engineering firm. Prior to that, he was associated with Baker Brothers, Inc., Toledo, Ohio, for many years. Also announced was the appointment of **JAMES E. BARNES** as sales manager. During the last four years, Mr. Barnes has been one of the key sales engineers of the company.

**JOHN BOOTH** was named vice-president in charge of research of the Abrasive Dressing Tool Co., Detroit, Mich. Mr. Booth will head the company's research and study program of the Red Band Diamond Tool development and new trends in industrial diamond research.

**VICKERS INCORPORATED**, Detroit, Mich., announces the following appointments: **W. F. DRIVER**, manager—industrial products sales; **EVERETT O. CLARK**, manager of the company's Midwest branch; and **OWEN C. DAVIS**, treasurer.

**ANGELO J. PERNA** has been appointed director of engineering of the Kaydon Engineering Corporation, Muskegon, Mich.

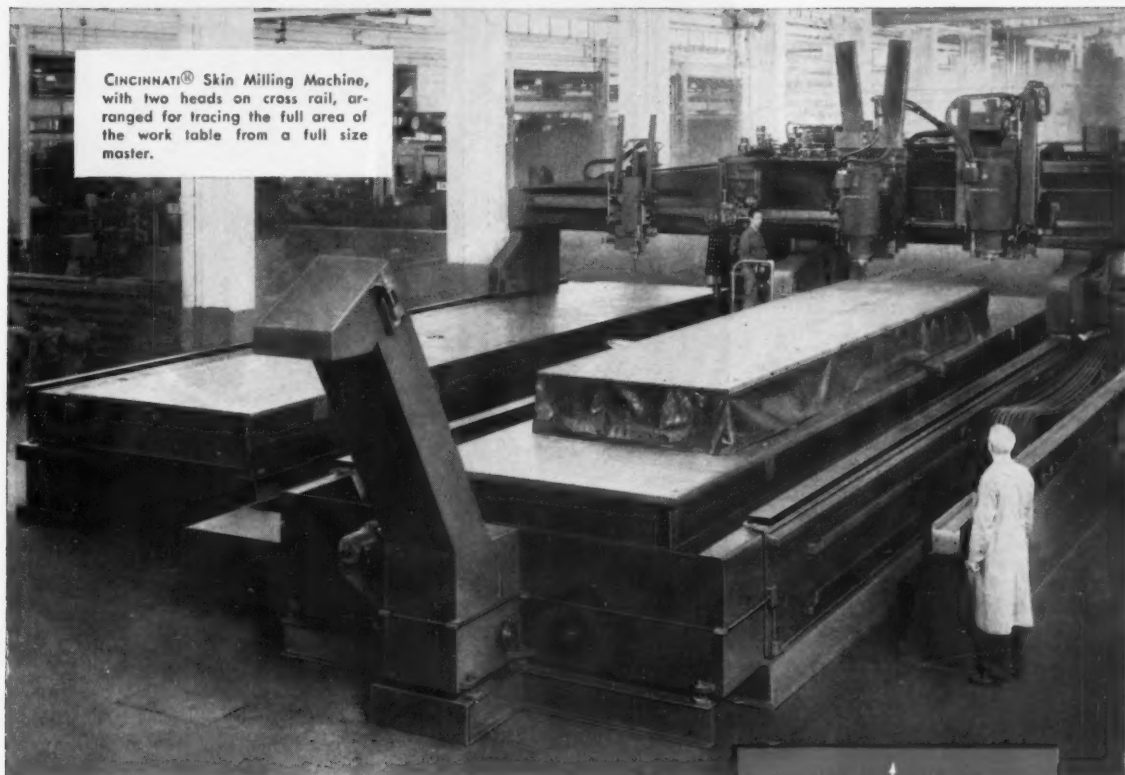
**CHARLES W. DAVIS** has joined the sales staff of the Bohn Aluminum & Brass Corporation, Detroit, Mich.

## New England

**NORTON CO.**, Worcester, Mass., announces the appointment of the **RUDEL MACHINERY CO., INC.**, 100  
(Continued on page 258)



CINCINNATI® Skin Milling Machine, with two heads on cross rail, arranged for tracing the full area of the work table from a full size master.



## CINCINNATI Skin Milling Machines

### HYDRAULIC-ELECTRIC TRACING

The smoothest and most flexible type of machine tool control. Proved by Cincinnati's many years of experience.

### TRACING HEADS

Each cutter head will cut chips over entire area of table.

Automatic tracing in horizontal and vertical planes from a single tracing unit.

High speed, slow speed and horizontal attachments available.

Heads swivel both longitudinal and cross.

### CUTTING FLUID AND CHIP CONTROL

Includes flushing system and chip separator.

Masters are free of chips.

### OTHER ADVANTAGES

Built-in operator safety.

Work and master are stationary.

Movable elements are anti-friction mounted; constant weight.

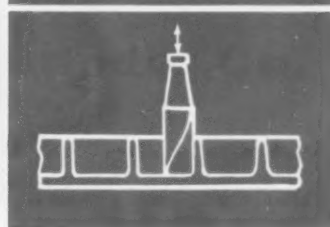
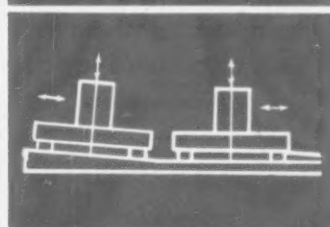
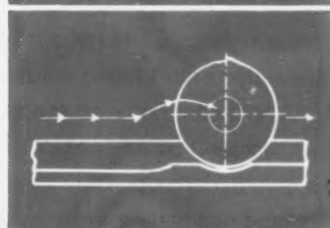
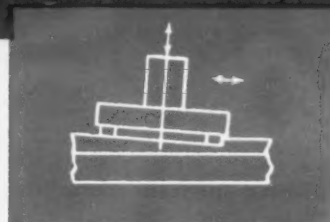
*Write for more information.*

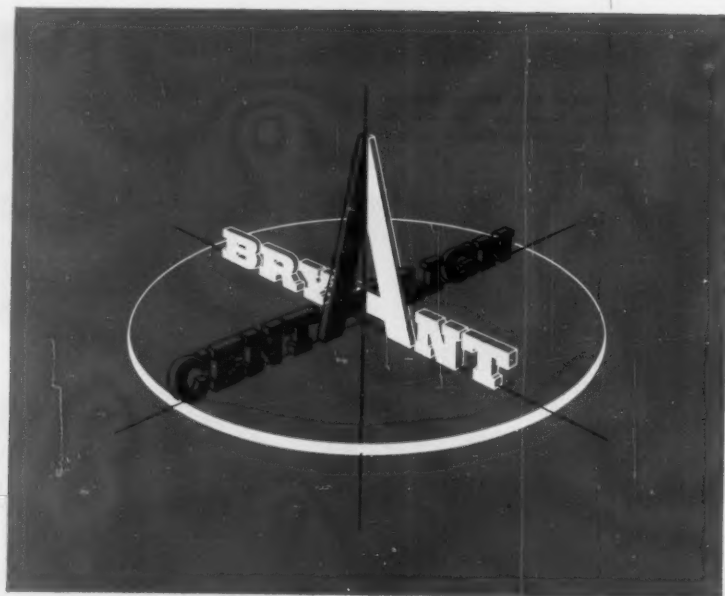
THE CINCINNATI MILLING MACHINE CO.  
CINCINNATI 9, OHIO

# CINCINNATI

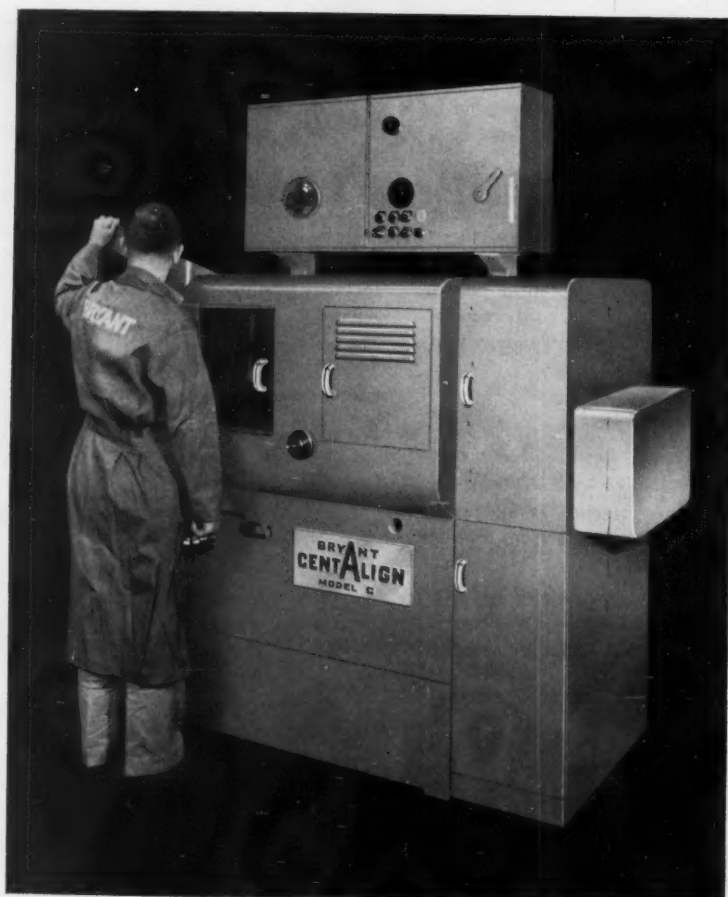


MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES  
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

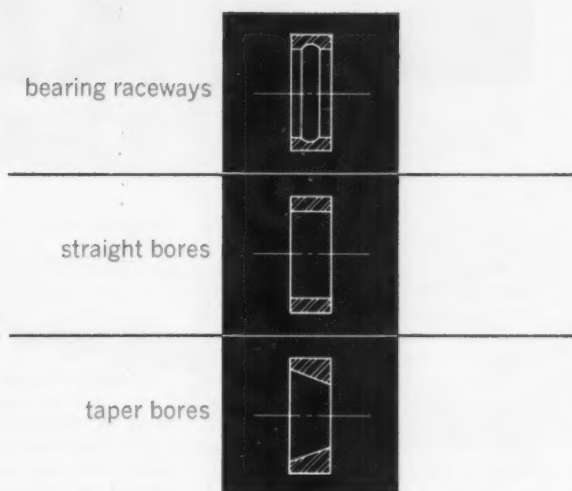




## The Fastest Internal Grinder



for



**Production runs prove that the Bryant "Centalign" cuts internal grinding time 20% to 50%!**

The "Centalign" is completely new, in design, in construction and in performance. Its high production rates, stability, accuracy and dependability result from completely new concepts like these: **1.** All loads and controlling forces are on a common plane, reducing deflection to a minimum and insuring permanent alignment. **2.** Control of machine function by readily interchangeable cam units for quick job change-over and precision machine operation. **3.** Simplified hydraulic servo control system combining the advantages of both cam- and hydraulically-operated machines for accurate machine control and extremely smooth, responsive operation. **4.** Unit-type construction, ideal for use in automated lines. **5.** Extremely rigid, stable construction, guaranteeing continually accurate production.

If internal grinding efficiency is important to you, you can't afford not to investigate the "Centalign". Ask for an immediate demonstration!

## **BRYANT Chucking Grinder Co.**

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers

E. 42nd St., New York City, as distributor for Norton precision grinding and lapping machinery in eastern New York, northern New Jersey, Connecticut, and western Massachusetts. Announced was also the appointment of HOMER L. GIBBS as field engineer in the company's St. Louis, Mo., office. Mr. Gibbs has been an instructor in the Norton School of Grinding since 1953. Previous to that time, he had been a member of the manufacturing control department.

JAMES R. KEOUGH has been appointed manager of manufacturing at Fenwal, Inc., Ashland, Mass. He will be responsible for production, manufacturing methods, quality control, standards and systems, and purchasing activities for the manufacture of precision temperature controls and overheat detectors which the firm manufactures for industrial and aviation use. Mr. Keough has been with the company since 1951.

JAMES MASON has been appointed district manager of the Leland-Gifford Co., Worcester, Mass., following the retirement of E. A. Heidlinger, who has been with the company for the last forty years.

DR. HOWARD O. McMAHON, science director of Arthur D. Little, Inc., Cambridge, Mass., has been elected president of the company.

CHARLES V. STEVENS has been appointed sales manager of the S. W. Card Mfg. Co., Division of Union Twist Drill Co., Mansfield, Mass.

SKINNER CHUCK CO., New Britain, Conn., announces the election of three new vice-presidents: D. M. STEVENSON, vice-president—sales; G. A. GEOPFRICH, vice-president—engineering; and R. D. TWOHIG, vice-president—financial, legal, and other staff activities.

HELI-COIL CORPORATION, Danbury, Conn., announces the following appointments: EDUARD BARUCH, president; WALTER MANN, executive vice-president; LOUIS RIPLEY, chairman of the board.

GEORGE J. CARVALHO has been named general manager of JARVIS POWER TOOLS, INC., Middletown, Conn. Mr. Carvalho was formerly manufacturing superintendent of the Universal Winding Co., Cranston, R.I.



Edward P. Gillane, recently elected executive vice-president, Pratt & Whitney Co., Inc.

EDWARD P. GILLANE has been elected executive vice-president and a director of the Pratt & Whitney Co., Inc., West Hartford, Conn. J. POTTER CUNNINGHAM was elected president of Potter & Johnston Co., subsidiary of Pratt & Whitney, succeeding Mr. Gillane. At the same time the appointment of RICHARD D. KELLER as assistant sales manager of the machine tool division, Pratt & Whitney Co., Inc., was announced. Mr. Keller joined the experimental department of the company in 1930.

GORDON W. SMITHSON has been named vice-president and chief engineer of Potter & Johnston Co., Pawtucket, R. I. Associated with the



Gordon W. Smithson, recently named vice-president and chief engineer of Potter & Johnston Co.



J. Potter Cunningham, president, Potter & Johnston Co., a subsidiary of Pratt & Whitney Co.

company since 1936, Mr. Smithson has held the position of chief engineer since 1953.

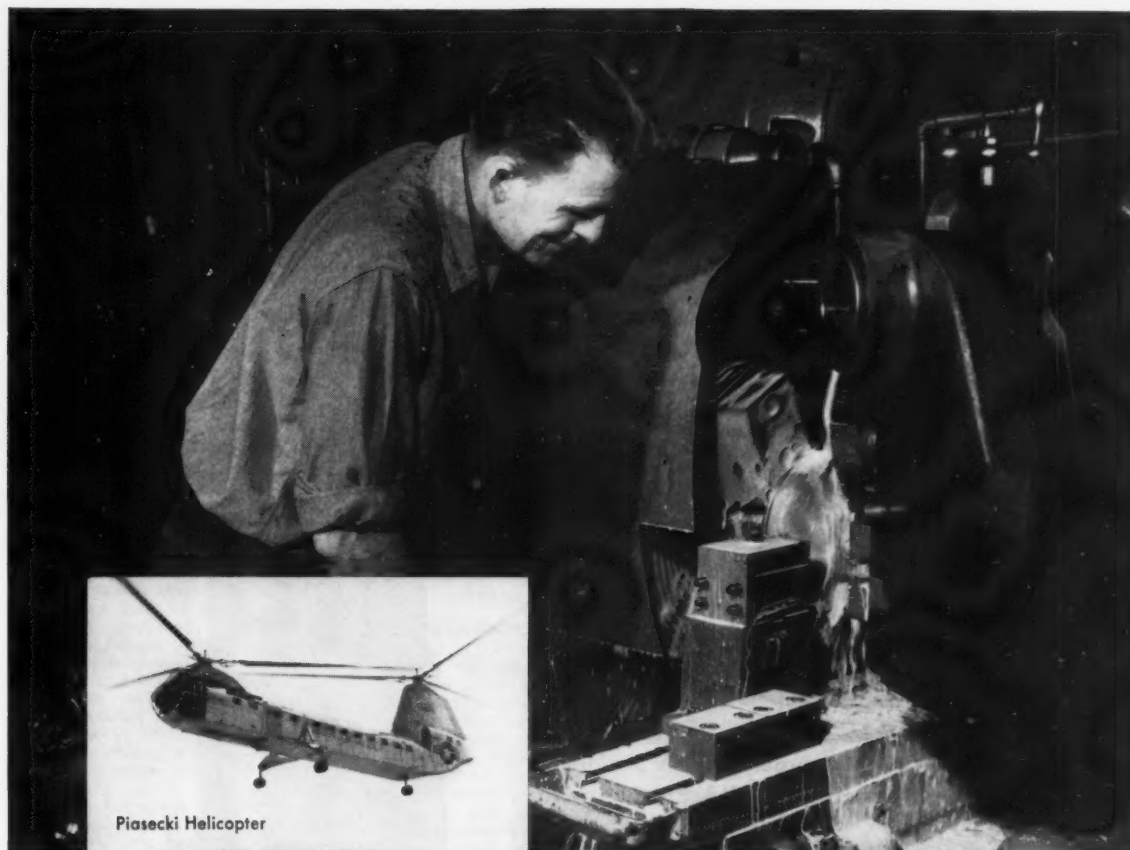
## New York and New Jersey

ACHESON INDUSTRIES, INC., New York City, announces the elections of M. W. REYNOLDS and P. C. BUCK to the board of directors. Mr. Reynolds, who has been general manager of the Acheson Colloids Co., as well as a vice-president of Acheson Industries, Inc., will take on new duties as vice-president in charge of Acheson Industries' recently formed International Development Division. He will be assisted by PAUL BARNES. JOHN W. SHIER was named general manager, succeeding Mr. Reynolds. Mr. Buck will continue serving Acheson Industries in his present capacity as vice-president in charge of production and engineering with offices at Port Huron, Mich.

JAMES VAN HORNE LAWRENCE has been named director of engineering orientation of Ford Instrument Co., Division of Sperry Rand Corporation, Long Island City, N.Y. In the newly created post, Mr. Lawrence will be responsible for preparing new engineering employees for their initial project assignments by directing a twenty-day course.

WILLIAM E. RUDEL has been appointed to the newly created post of executive vice-president of the Rudel Machinery Co., New York City. At the same time it was announced that HERMAN F. ZORN, sales engineer in  
(Continued on page 266)





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S.E.C.O. Heavy Duty handles all machining jobs requiring an emulsifying cutting oil. Piasecki Helicopter's large job shop at Morton, Pa., found this out three years ago when S.E.C.O. HD\* replaced two expensive heavy-duty soluble oils in machining fan hubs.

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MACHINERY, July, 1956—259

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## CP Air-Saw CUTS and FILES...

**Stainless Steel, Nickel, Copper, Aluminum, Iron,  
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Use it as a saw or a file on heavy-duty production line work. Fit it with a blade and it becomes a utility saw capable of cutting practically every material and every possible shape . . . steel blade stock from your all-purpose band saw can be used for special applications. Add a file chuck and use it with round or flat shank files. Conversion takes 60 seconds. Designed with Variable Speed Control, its cutting action can be regulated to suit your work conditions. For details, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

### Examples of its thousand-and-one uses

1. **In Receiving and Shipping** — opening wooden boxes and crates.
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6. **In Plant Maintenance** — blind sawing in duct and piping work.



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On New Shop Equipment described in the editorial pages  
On products shown in the advertisements

## NEW CATALOGUES

**LUBRICATION GUIDE**—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. 20-page catalogue covering lubrication systems and requirements of all machinery built by the company's four divisions. Equipment covered includes: bolt, nut, screw, and rivet machinery; power presses; wire, rod, and tube machinery; and rolling mill machinery. The catalogue, extensively illustrated, explains in detail the following systems used singly or in combination on the company's machines: circulation oiling, centralized pressure lubrication, bath-splash, centralized gravity feed, and hydraulic systems. Additional information is given on pressure fittings, grease-cups, oil-cups, ring oiling, and hand application of lubricants. Free copies of this guide may be obtained by writing to the above company.

**MACHINE TOOL ELECTRICAL STANDARDS**—National Machine Tool Builders' Association, 2071 E. 102nd St., Cleveland 6, Ohio. 44-page revised manual of machine tool electrical standards, containing a great deal of additional data, much of it presented in tabular form. The new standards have been developed specifically for application to machine tools and represent the consensus of many skilled minds under the industry's latest technological developments. An index and a glossary of electrical terms are especially valuable additions to the new manual. Copies may be obtained upon request to the Association.

**PROCESSING MACHINERY**—Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn. 44-page booklet No. 59, entitled "This is Farrel-Birmingham." This booklet, with the aid of well-selected illustrations, gives a factual presentation of the company's facilities for producing a wide variety of heavy machinery and machine tools. Copies can be obtained by writing to the above company.

**AIR GAGES**—Federal Products Corporation, Providence, R. I. Catalogue 56D, describing the balanced air system used in the company's Dimensionair air gages and the advantages which result from this system. The two most notable advantages are the precisely calibrated scale, which allows the gage to be set with only one master, and the stability, which means that there is no creep or drift once the gage is set. Among the items listed are matched AirProbes which are used to

offset the effect of eccentricity when measuring several diameters on the same work-piece; the differential air meter (AME-17) for direct reading of taper and parallelism measurements; and the Probe-X, a new air attachment for the Arnold continuous grinding gage. Included are also a list of air plugs—both through hole and blind hole—that are available from stock, as well as a chart listing semi-finished plugs. ....1

**SUBMINIATURE SWITCHES**—Micro Switch, a Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Catalogue 75a, describing the company's subminiature switches which can handle high electrical loads on both alternating- and direct-current circuits. In addition to the wide variety of basic switches, toggle assemblies, rotary selector switches, and push-button assemblies, information on many new subminiature switches and assemblies is given. Included are also completely sealed environment-free subminiature switches and actuators, illuminated push-button assemblies, light force push-button switches, and a new series of sealed, multi-circuit toggle switch assemblies. ....2

**BURR-BLAST MACHINES**—Modern Industrial Engineering Co., Detroit, Mich. 4-page catalogue BB-1, describing the company's Burr-Blast method for removing fragmentary burrs from finish-machined cast iron or non-ferrous parts. Three basic designs of Burr-Blast machines are described: stationary machines with manual loading; rotary machines for continuous operations with manual loading; and in-line continuous operating machines with either manual or automatic

loading. Information is also given on typical parts that have been Burr-Blasted on the various models described, and a short description of the various blasting materials that have been used in these machines is included. ....3

**SPEED REDUCERS**—Cone-Drive Gears, Division of Michigan Tool Co., Detroit, Mich. Bulletin 600-C, describing the company's standard cone drive reducers. Specifications and horsepower ratings for models from 2- through 6-inch center distance are presented. Cut-away photos, dimensional drawings, and horsepower ratings at all speeds and ratios illustrate the bulletin. All of the standard cone drive reducers covered in this bulletin are available with worm over or under, or gear shaft vertical. Each standard model is also available with single- or double-extended shaft or shaft mounted, or either version as motorized models. ....4

**TOOL-HOLDERS AND CARBIDE INSERTS**—Vascoloy-Ramet Corporation, Waukegan, Ill. 24-page catalogue VR-437, describing the company's complete line of tool-holders and carbide inserts. A description is given of both positive and negative rake tool-holders utilizing throw-away inserts and negative rake tool-holders using standard inserts up to 1 1/2 inches long. Both carbide and ceramic inserts can be used. Recommendations covering carbide grades to use for various machining operations on different materials are also included. ....5

**PUNCHING AND NOTCHING EQUIPMENT**—Punch Products Corporation, Niagara Falls, N. Y. Ring-bound catalogue describing and illustrating the company's

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Unipunch series A and B hole-punching units, Uninotch series A and B notching units, Series AE hole-punching units, as well as Unipunch C hole-punching units. These units are all components of the Unipunch tooling method which consists of a wide range of standard individual hole-punching and notching units with punches and dies held in fixed alignment, permitting any number of units to be mounted in a set-up outside the press for immediate use on press beds. ....6

**TORQUE MANUAL**—P. A. Sturtevant Co., Addison, Ill. Second Edition of this manual has been expanded to include additional torque application formulas and suggested application illustrations. Tables show screw torque data including minimum torsional strength tabulations, torque and tension relationship charts for high-tensile and mild steel screws, and torque conversion tables. Explanations and solutions to adapt to problems of both special torque wrench adapters and attachments and more complete information covering the general principles of torque wrenches are given. ....7

**LIMIT SWITCHES**—R. B. Denison Mfg. Co., Cleveland, Ohio. Bulletin 356, describing the company's nineteen contact arrangements available with seven Denison Loxswitch models. The direction of lever movement, direction of spring return, and normal and operated circuits for each position are given in handy table form. Comparative statistics are also given of the three leading machine tool limit switches based on independent laboratory tests, together with a report on a test conducted by a machine tool manufacturer. ....8

**FOUNDRY EQUIPMENT**—Newaygo Engineering Co., Newaygo, Mich. Bulletin 56, entitled "More Molds with Fewer

Motions," describing the importance of proper mechanization and automation for efficiency in foundry operations. Bulletin lists complete sand handling, mold handling, and mold making equipment. Bulletin is illustrated with on-the-job photos showing pertinent features of construction and operation. Data, complete with facts and figures, points out how this equipment can be used to speed production and cut costs. ....9

**LATHES**—Logan Engineering Co., Chicago, Ill. Catalogue describing the company's screw-cutting and turret lathes, including cabinet models, pedestal base models, and floor and bench models. The lathes illustrated and described range in size from the 14-inch swing, No. 6560 through a complete line of 12- and 11-inch swing lathes with 1-inch collet capacity and 1 3/8-inch spindle bore, and an enlarged group of 10- and 9-inch swing lathes with 1/2-inch collet capacity. ....10

**UNDERDRIVE PRESSES**—Danly Machine Specialties, Inc., Chicago, Ill. 32-page illustrated catalogue giving information on the company's line of single-, double-, and triple-action underdrive presses ranging in capacity from 400 to 2000 tons. The largest bed size shown in the catalogue is 200 by 100 inches, but larger sizes can be manufactured to specifications. These presses are specifically intended for volume production of large stampings, automobile and major appliance body sections, sinks, tanks and cylinders, and similar large pieces. ....11

**INDEX-TABLES AND ROTARY TRANSFER MACHINES**—Ferguson Machine & Tool Co., Roller Gear Division, St. Louis, Mo. 24-page catalogue 301, giving load ratings and dimensions of more than 150

standard, high-speed "Intermittor" indexables. The line, including dial sizes ranging from 12 to 120 inches with from four to thirty-six stations—featuring extreme precision without auxiliary locking methods—is available from stock. Standard power assemblies, stands, and control panels may also be ordered from stock to form a complete rotary transfer machine for automatic assembly. ....12

**SPACING COMPARATOR**—Jerpak-Bayless Co., Solon, Ohio. Leaflet describing the company's portable spacing comparator which checks spacing of flat and circular thread-rolling dies; thread chasers; circular and flat form tools; wheel crusher rolls; gear racks; broaches; aircraft parts, such as turbine blades; and the location of forms from their locating face or surface, as well as the inspection on all threaded products. Leaflet also contains descriptive information on the accessories available. ....13

**WELDING ELECTRODES**—Lincoln Electric Co., Cleveland, Ohio. Catalogue SB-1351, entitled "Weldirectory for Mild Steel and Low-Alloy High-Tensile Steels," giving information on the newest iron powder and other electrodes. This catalogue provides a description of each electrode, its physical properties and chemical composition, recommended welding procedures, an operator's reference table, and a list of typical applications for each electrode. ....14

**WELDING EQUIPMENT**—General Electric Co., Schenectady, N. Y. 20-page catalogue GEC-1033, covering all types of the company's welding equipment, electrodes, and accessories. Included are alternating-current and direct-current, general purpose, and industrial welders, semi-automatic and automatic equipment, and carbon block brazing equipment. Ratings, dimensions, and specifications are given for all equipment as well as complete description and analysis for electrodes. ....15

**ELECTRIC BRAKES AND CLUTCHES**—Warner Electric Brake & Clutch Co., Beloit, Wis. Illustrated catalogue WEB 6212, giving information on the company's line of electric brakes and clutches. These devices utilize an electromagnetic principle to provide a simpler, more versatile way to control a wide variety of machine motions. Electrical actuation time can be measured in millisecond seconds, and mechanical translation time can be eliminated completely, permitting faster, more accurate starts and stops. ....16

**INDUSTRIAL PRESSES**—Manley Division, American Chain & Cable Co., Inc., York, Pa. 16-page bulletin designated DH-486, describing the company's line of hydraulic and air-operated industrial presses of 25- to 150-ton capacity. Ten different models for various industrial requirements are featured. Detailed specifications, capabilities, capacities, and accessories have been incorporated in tabular form, together with photographs and outline drawings. ....17

**GAGING SYSTEMS**—Federal Products Corporation, Providence, R. I. Catalogue 56 AM, giving information on the four gaging systems used for automatic control: electric; air-electric; electronic; and air-electronic, and describing the components that make up each system. In addition, the various types of control gaging for automation, such as on-the-ma-

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chine, after-the-machine, continuous process, and several others are fully delineated. ....18

**LUBRICATORS**—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin 3-B, describing the company's automatic, cyclic type lubricators that provide positive metered oil feed by a simple mechanical drive from the machines they lubricate. These lubricators can provide automatic lubrication to a wide range of metal-working machinery, printing presses, packaging machinery, machine tools, and a variety of special machinery. ....19

**STAINLESS-STEEL PIPE**—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. Bulletin TB-410, giving information on the use of seamless and welded stainless-steel pipe and stainless-steel welding fittings where corrosion or elevated temperatures are determining factors. The folder contains application data on the most widely used stainless steels, and furnishes helpful hints on the bending, joining, and welding of these products. ....20

**DIE CUSHIONS**—Danly Machine Specialties, Inc., Chicago, Ill. 24-page catalogue describing all types of the company's die cushions for presses with J.I.C. bed openings from 14 by 14 inches to 213 by 87 inches. Included are pneumatic, multiple-piston pneumatic, pneumatic locking, hydropneumatic, and custom type cushions ranging in capacity from 3.93 to 301.5 tons at 100 pounds per square inch. Complete performance and dimensional data on all cushions is provided. ....21

**TURBINE GENERATORS**—Steam Turbine Division, Worthington Corporation, Harrison, N. J. 35-page bulletin 1960C-P, describing the company's generators covering a 1500-to 15,000-K.W. range. Contents include complete information on types and applications, turbine and generator construction, testing and lubrication, sole plates, design features, and lagging. Also included are various illustrations of industrial and municipal turbine generator installations. ....22

**UNIT HEATERS**—American Air Filter Co., Inc., Louisville, Ky. 36-page bulletin 700A, giving specifications and complete performance data for Herman Nelson horizontal and vertical unit heaters. The bulletin includes complete hot water and steam performance tables; dimensions; selections; applications; descriptions of cabinets, elements, motor mountings, fans and accessories; controls; suggested lay-outs; piping diagrams; and other technical data. ....23

**HEAT-TREATMENT**—Beryllium Corporation, Reading, Pa. 8-page catalogue describing the methods and procedures used in heat-treating Beryllium copper wrought and casting alloys. Divided into two sections—the first covers wrought alloys. Details are given on how they are supplied and a description of both standard and special methods of heat-treat hardening. Information is also included on fixtures, furnaces, annealing methods, cleaning, and brightening. ....24

**LUBRICATION AND COOLANT SYSTEMS**—Dravo Corporation, Pittsburgh, Pa. Illustrated bulletin 1450, describing the company's lubrication and coolant systems which are custom designed to supply the correct amount of lubricant to

the right place at the proper temperature and pressure to meet specific requirements. The bulletin also describes the company's Unilube units which are compact "packaged" lubrication systems. ....25

**POWER CONVEYORS**—Harry J. Ferguson Co., Jenkintown, Pa. Illustrated catalogue describing the company's nineteen different types of power conveyors. Included are size and dimension data, plus installation photos showing the conveyors in operation. Portable, stationary, horizontal, and inclined types of power conveyors are shown, plus floor-to-floor conveyors, power belt corner, and power roller curves. ....26

**MINIATURE FLEXIBLE COUPLINGS**—Thomas Flexible Coupling Co., Warren, Pa. Bulletin MC-100, describing standard and special miniaturized couplings, which can be used in servomechanisms, computers, and other small devices. These couplings are designed for speeds up to 50,000 R.P.M. and will compensate for parallel and angular misalignment while relieving bearing loads, holding constant torque and synchronism. ....27

**FILTERS**—Cuno Engineering Corporation, Meriden, Conn. Catalogue 052, describing the company's filters for raw water, light process liquids, and centralized coolant systems. These filters can handle up to 15,000 gallons per minute in a single unit and can filter down to 0.0025 inch. They are continuously and automatically self-cleaning, require minimum maintenance, and occupy small floor space area. ....28

**PROFILOMETER**—Micrometrical Mfg. Co., Ann Arbor, Mich. 14-page catalogue describing Profilometer equipment for shop measurement of surface roughness. For easy reference, this catalogue is arranged in sections covering equipment for manual operations, portable equipment for straight line mechanical tracing, equipment for straight line mechanical tracing on hard-to-reach surfaces, and equipment for circular tracing. ....29

**TITANIUM CORROSION RESISTANCE**—Mallory-Sharon Titanium Corporation, Niles, Ohio. Bulletin containing data on the corrosion resistance of titanium and suggestions where this new metal can be

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applied to overcome corrosion problems. Various uses of titanium are described, and the booklet contains corrosion ratings for that metal when exposed to many common types of corrosive agents. . . .30

**NICKEL ALLOY TUBING**—Superior Tube Co., Norristown, Pa. 20-page catalogue entitled "Superior Tube Nickel and Nickel Alloy Tubing," giving information on nickel and nickel alloys. In addition to a general discussion of the properties of nickel and nickel alloys as a class, the catalogue tabulates the specific mechanical properties and chemical composition of thirteen analyses of nickel and nickel alloy tubing. . . .31

**CEMENTABLE TAPE**—Garlock Packing Co., Plastics Division, Palmyra, N. Y. Leaflet describing the company's cementable Teflon tape which is available in thicknesses as low as 0.005 inch. Formerly this tape has been limited to thicknesses of 1/16 inch and up. The new tape will expand the use of Teflon as linings for conveyor guide rails, hoppers, and other corrosive materials. . . .32

**ADJUSTABLE SHELVING**—Hallowell Division, Standard Pressed Steel Co., Jenkintown, Pa. Catalogue giving informa-

tion on how to plan installations and order shelving in more than 1000 combinations to fit any storage or supply-handling need. Drawings of basic units and accessories, suggested floor plans, a shelf capacity chart, and photographs of complete units make the catalogue a useful guide to planned storage. . . .33

**GRAPHS AND CHARTS**—Chart-Pak, Inc., Stamford, Conn. 20-page catalogue entitled "Visualization Made Easier," describing the company's method of making organization and flow charts, graphs, and office and plant lay-outs. The method consists of "drawing" with pressure-sensitive tapes and templates. Commonly recognized lines, shapes, bars, symbols, and die-cut office furniture templates are pre-printed on tapes or sheets. . . .34

**INDUSTRIAL SPECTROGRAPH**—Jarrell-Ash Co., Newtonville, Mass. 8-page catalogue illustrating and describing the Spec-Lab, a high-precision, industrial spectrograph. The catalogue gives a detailed description of the performance and application of each of the three models available. Included are reproductions of spectrograms, made with the instrument, that provide an indication of its resolving power. . . .35

**BRONZE BEARINGS**—Amplex Division, Chrysler Corporation, Detroit, Mich. Catalogue S-56, describing the company's Oilite bronze bearings. A total of 1050 different sleeve, flange, and thrust bearings can be supplied. Oilite bearings are used for original equipment and maintenance in automotive, industrial, aircraft, and other fields. . . .36

**ALUMINUM NAMEPLATES**—North Shore Nameplate, Inc., Bayside, N. Y. 4-page brochure illustrating and describing the company's Thermo-Cal all-purpose aluminum nameplates for use on irregular surfaces and crinkle finishes. Shown are typical applications: dials, scales, instruction plates, and schematic drawings. Photographs illustrate two bonding methods which can be used—solvent activation and heat activation. 37

**POWER TRANSMISSION EQUIPMENT**—Lovejoy Flexible Coupling Co., Chicago, Ill. 12-page technical brochure describing the company's full line of power transmission equipment, including flexible couplings, variable-speed pulleys and transmissions, universal joints, and motor bases. Information includes operating data, horsepower ratings, sizes and types for various applications, and widely varying working conditions. . . .38

**FASTENERS**—Cleveland Cap Screw Co., Cleveland, Ohio. Pocket-size card listing physical properties of fasteners manufactured by the company, available to engineers, draftsmen, and others in the metal-working industries. Physical properties such as steel analysis, head marking, and tensile strength are given. . . .39

**WIRE FORMING**—Risdon Mfg. Co., Nautogutuck, Conn. 4-page bulletin entitled "Wire Forming Specialists," illustrating and describing the company's facilities for pointing, forming, stamping, and finishing of products and components. In addition, the brochure illustrates pointing, threading, and other wire end operations performed by the company. 40

**WELDING OF STEEL CASTINGS**—Templ Corporation, New York City. 40-page booklet entitled "Recommended Practice for the Welding of Steel Castings," published by the Steel Founders Society of America. A limited number of this booklet, normally obtainable for thirty-five cents, is being made available free of charge by the above company. . . .41

**ROTATING LIMIT SWITCH**—Furnas Electric Co., Batavia, Ill. Bulletin 5605, giving design features and engineering data on the company's rotating limit switch with heavy-duty pilot ratings up to 480 volts. The bulletin also contains voltage rating charts, dimensional diagrams, wiring illustrations, application photos, and list prices. . . .42

**CABLE-LAID SLINGS**—American Chain & Cable Co., Wire Rope Sling Department, Wilkes-Barre, Pa. Bulletin DH-532A, describing the company's cable-laid wire rope slings that offer flexibility of hemp, strength of steel, kink-free construction, and a bright Galalco finish. The cable-laid line is available in a wide variety of sizes and styles. . . .43

**AIR GAGING**—Taft-Peirce Mfg. Co., Woonsocket, R. I. Illustrated folder entitled "Air Gage for Lower Costs," dealing with automatic gaging as applied to mass-production automation operations. Information is also given on semi-automatic and manual applications. . . .44

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2100 South Laramie Ave., Dept. C, Chicago 50, Ill.

the Schenectady area, was elected a member of the board of directors.

ENGINEERING SUPERVISION Co., New York City, consulting and management engineers owned by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has moved to 120 West 42nd Street, New York 36, N. Y.

AIR REDUCTION Co., INC. has moved its executive offices to 150 E. 42nd St., New York City. The company will occupy the third and fourth floors of the building.

HARRY J. VOLK has been elected director and a member of the finance committee of Servomechanisms, Inc., Westbury, L. I., N. Y.

KELITE PRODUCTS, INC., Berkeley Heights, N. J., announces the following appointments: ALBERT W. LUPIN has been promoted to regional vice-president; W. JOHN BOYD was named metropolitan Chicago district sales manager; GURDON T. HENRY was appointed district sales manager in the Ohio area; and G. STUART KRENTSEL was made manager of technical sales service for the western region.

STAINLESS WELDED PRODUCTS, INC., Clifton, N. J., has changed its name to SWEPCO TUBE CORPORATION.

## Ohio

CINCINNATI MILLING MACHINE Co., Cincinnati, Ohio, announces the election of WALTER W. TANGEMAN,

executive vice-president since 1934, as chairman of the board. SWAN E. BERGSTROM, who joined the company in 1927, became vice-president in 1949, and manager of the machine tool division in 1954, was named executive vice-president. F. V. GEIER continues as president. Other officers re-elected are: vice-presidents, C. F. ROBY, H. A. GAY, and MILLARD ROMAIN; treasurer, F. M. ANGEVIN; secretary, P. H. CONE.

R. O. PETERSON has been elected vice-president, Brush Division—Engineering of the Osborn Manufacturing Co., Cleveland, Ohio. In his new capacity, Mr. Peterson will assume increased responsibility in the program of research and development on power brushing methods and brushing machines. He has been associated with the company since 1936 when he joined the organization as manager of the technical department.

JOHN A. MATOUSEK has been named assistant to the president of the Baker-Raulang Co., Cleveland, Ohio. In his new capacity, he will aid on general staff problems and handle special assignments in fleet sales, new market and product programs, and industrial relations.

EDWARD C. WILLIAMS, JR. has been appointed manager of customer relations of the Wellman Bronze & Aluminum Co., Cleveland, Ohio. For the past four years Mr. Williams has been associated with the Alloy Precision Castings Co. as sales service manager.

GLEN J. HARTMAN was appointed manager of operations of Ohio Seamless Tube Division of Copperweld Steel Co., Shelby, Ohio. He succeeds RAYMOND E. DEWEY. Mr. Hartman served previously as assistant manager of operations.

STERLING DIE DIVISION of PRATT & WHITNEY Co., INC., Southwest Industrial Park, Cleveland, Ohio, will be ready for occupancy in October, 1956.

LIMA ELECTRIC MOTOR Co., Lima, Ohio, announces the opening of a new branch office at 6432 Cass Ave., Detroit, Mich.

CLARK R. HIBBARD has been promoted to sales manager of the Fosted Machine Tool Co., Cincinnati, Ohio.

## Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the following appointments: KENNETH M. ACTON has been made manager of the San Francisco, Calif., sales branch. He replaces ROBERT M. SIMPSON, who has been appointed manager of the Los Angeles, Calif., sales branch. Announced was also the appointment of A. H. LEWIS as manager of tool steel sales at the company's headquarters. Mr. Lewis formerly held the position of sales manager of the Vacuum Metals Corporation.

DELTA POWER TOOL DIVISION OF ROCKWELL MFG. Co., Pittsburgh, Pa., announces the formation of a specialty products sales department headed by GEORGE E. ROCKWELL. Five metal-working lathe specialists have been appointed for that department. They are: GEORGE G. GEORGE, HERBERT GEGENHUBER, JACK STEELE, HAROLD JONAS, and DOUGLAS R. FINCH.

REMUS A. LULA, who has been a research supervisor for Allegheny Ludlum Steel Corporation since 1954, has been named associate director of research—stainless steel at the company's research laboratory at Brackenridge, Pa. Mr. Lula has been with the company since 1950.

WILLIAM L. SLOTTER and JOSEPH H. JUDD have been named to two newly created positions in the treasurer's office at Standard Pressed Steel Co., Jenkintown, Pa.

(Continued on page 270)



(Left) Walter W. Tangeman, chairman of the board, and (right) Swan E. Bergstrom, executive vice-president, of Cincinnati Milling Machine Co.



**NEW**

**AMERICAN offers SYNTHETIC FELTS**

## Thermal Resistance...Chemical Resistance!

### Now Available!

- **DACRON\***
- **ORLON†**
- **NYLON**
- **ARNEL®**
- **ACRILAN\*\***
- **DYNEL††**

Send today for fact sheets!

\*DuPont trademark for its polyester fiber

†DuPont trademark for its acrylic fiber

\*\*Acrylic fiber by Chemstrand

††Union Carbide's acrylic fiber

Now, American, through its technical research, has perfected the mechanical interlocking of the man-made fibers listed at the left, to produce three-dimensional felt structures.

These new Felts by American have exceptional *chemical resistance* with *thermal stability* to 300 F. They are non-hygroscopic, biologically stable and are available in a complete range of thicknesses. Precision engineering assures close

density and thickness control.

The properties which characterize these new Felts are being utilized in filtration—laminated plastics as reinforcing material—high temperature bearing seals—gasketing. In fact, end uses are unlimited!

American's engineering and research staff is prepared to supply you with complete data and product recommendations. Write today!

**American Felt  
Company**

TRADE MARK  
GENERAL OFFICES:

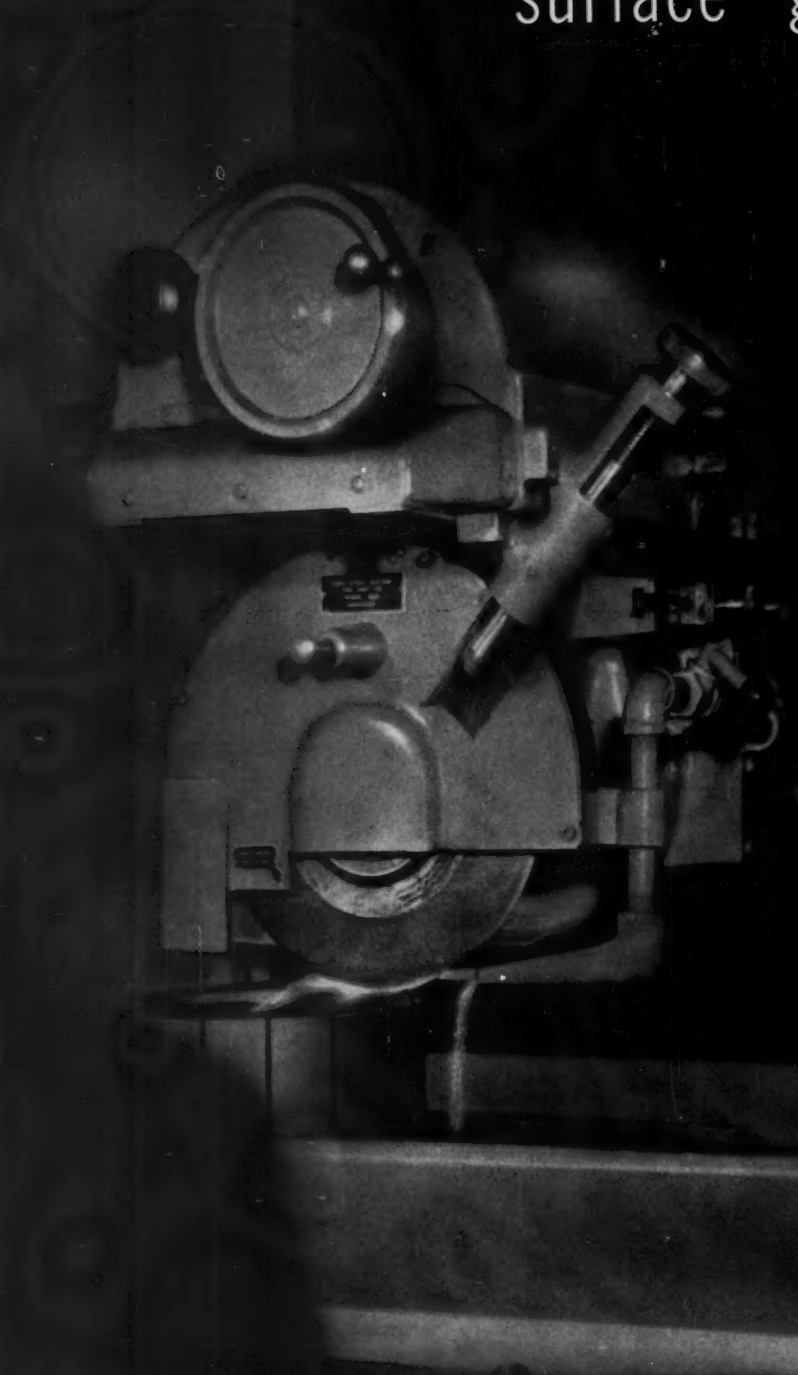
68 GLENVILLE ROAD GLENVILLE, CONN.

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Greenville, S. C., Dallas, San Francisco, Los Angeles, Portland, San Diego, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.



WORLD'S MOST COMPLETE LINE

of hydraulic  
surface grinders



# invites your attention...

name the surface grinding job... Thompson has the machine

## Thompson Type B

Surface dies or parts  
faster to part print,  
at lower cost,  
within wide size range

work size

6" x 18"  
to  
12" x 120"

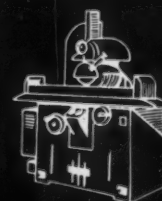


## Thompson Type F

For greatest precision,  
sensitivity and versatility  
in toolroom... or parts  
production at low cost

work size

8" x 18"  
and  
8" x 24"



## Thompson Type C

Meets production and  
cost demands in larger size  
surface work of all types

work size

12" x 40"  
to  
24" x 168"

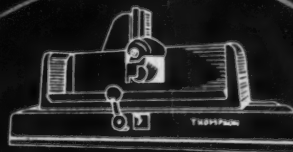


## Thompson Type CX

Offers both power and  
precision for heavy duty  
production... fast, accurate

work size

30" x 72"  
to  
36" x 240"



**Thompson**  
SURFACE  
Grinders

Including a complete line of Truform,  
Hydrail, Hydrovert, Twin Rotary  
and other special grinders  
for all sizes and types of work.

write for descriptive data

THE THOMPSON GRINDER COMPANY  
SPRINGFIELD, OHIO



Frank E. Stehlik, general manager of the General Electric Low Voltage Switchgear Department

FRANK E. STEHLIK has been appointed general manager of the General Electric Co.'s Low Voltage Switchgear Department at Philadelphia, Pa. Mr. Stehlik succeeds R. H. JONES, who has been promoted to general manager, Air Conditioning Division. At the same time it was announced that JOHN S. MACDONALD has been named general manager of the company's Distribution Assembly Department in Plainville, Conn.

HARRY C. O'BRIEN, vice-president of the recently formed Kennametal Overseas Corporation, will be in charge of operations for the new firm. The corporation is a subsidiary of Kennametal Inc., Latrobe, Pa. Mr. O'Brien was in charge of export



Harry C. O'Brien, vice-president of Kennametal Overseas Corporation

activities for the parent company prior to the formation of the new corporation. He joined Kennametal in 1941.

U. S. STEEL CORPORATION, Pittsburgh, Pa., announces appointments of the following executives in the research and technology division: EDGAR C. BAIN, assistant executive vice-president—operations; J. B. AUSTIN, vice-president, fundamental research; and M. W. LIGHTNER, vice-president, applied research. These appointments follow closely the completion of the company's research center at Monroeville, Pa.

DR. RUSSELL C. BUEHL, formerly chief of the Bureau of Mines Pyrometallurgy Laboratories at Pittsburgh, has joined the staff of Rem-Cru Titanium, Inc., Midland, Pa.

L. W. ELLIOTT has been appointed sales manager of the Griffin Manufacturing Co., Erie, Pa.

### Wisconsin and Minnesota

DAVID J. MUNROE has been named president of the Webster Electric Co., Racine, Wis. He succeeds PRESTON G. CREWE, who was elevated to the newly created post of vice-chairman of the board of directors. ARTHUR C. KLECKNER was re-elected chairman of the board.

AMPCO METAL, INC., Milwaukee, Wis., announces the appointment of two distributors. Fullerton Steel & Wire Co., 6605 West Fullerton Ave., Chicago, Ill., and Copper & Brass Sales, Inc., 3000 East Woodbridge, Detroit, Mich.

HOWARD J. BOWMAN has been appointed director of research and development for Trent Tube Co., East Troy, Wis.

SHOPMASTER, INC., Minneapolis, Minn., which has been acquired by Jones and Lamson Machine Co., Springfield, Vt., announces the addition of three district sales managers. They are: JAMES ANDERSON—covering the upper Midwest area, including Minnesota, Iowa, North Dakota, South Dakota, Wisconsin, and northern Illinois. KENNETH McMILLAN will cover the western coastal states of California, Oregon, and Washington. WILLIAM LANE, JR. will represent the company in Missouri, Oklahoma, Kansas, Arkansas, Nebraska, and western Tennessee.

## Coming Events

SEPTEMBER 17-21—Eleventh International Instrument-Automation Conference and Exhibit sponsored by INSTRUMENT SOCIETY OF AMERICA to be held at the New York City Coliseum. The society, which has its headquarters in Pittsburgh, Pa., has opened temporary offices at 250 W. 57th St. in New York City, from which it will direct the conference and exhibit.

SEPTEMBER 25-28—IRON AND STEEL EXPOSITION to be held in the Cleveland Public Auditorium, Cleveland, Ohio.

SEPTEMBER 27-29—Thirty-third annual meeting and national supervisory development conference of the NATIONAL MANAGEMENT ASSOCIATION to be held at the Sheraton-Jefferson Hotel in St. Louis, Mo.

OCTOBER 22-26—NATIONAL INDUSTRIAL EXPOSITION to be held at Artillery Armory, 8 Mile Rd., Detroit, Mich. Top executives and organizations in industry and local governments are the sponsors in cooperation with the United States Departments of Commerce and Defense. Chairman of the Committee is Leeland M. Uhl. Exposition headquarters are at 927 Book Bldg., Detroit, Mich.

November 26-30—TWENTY-SECOND NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING under the auspices of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held at the New York City Coliseum in conjunction with the Society's seventy-sixth annual meeting. As heretofore, it will be under the management of the International Exposition Co.

\* \* \*

### Film on Tubing Available

A twenty-five-minute, 16-millimeter, black-and-white sound-motion picture "The Leading Role" is available on loan from the Formed Steel Tube Institute, 850 Hanna Bldg., Cleveland 15, Ohio. The film demonstrates the advantages of the tube as a structural form, tells how welded steel tubing is made, shows many different uses for tubing, reveals how tubing serves our everyday life, and shows typical fabrication of tubing into an automobile rear axle housing.



**in  
this  
line-  
up ...**

there's a specific  
*Lapmaster*  
to give you:

- 1 Precision Flatness
  - 2 Precision Finish
- in production quantities*

Parts large or small—tall or squat—whatever the case may be, there's a Lapmaster tailor-made to meet your production requirements at the lowest possible cost per piece.

If you are now lapping by other means—hand scraping or grinding—it will pay you to investigate the Lapmaster. Our fully equipped lapping laboratory is at your disposal to analyze your problem, test run a number of pieces and furnish you with a complete production report without obligation.

"John Crane" Lapmasters are capable of consistently producing flatness to less than one light band (11.6 millionths of an inch), micro-inch finishes of 2 to 3 RMS on all materials including cast iron, steel, magnesium, aluminum, brass, carbon, ceramics and plastics.

Crane Packing Company, 6433 Oakton St., Morton Grove, Ill. (Chicago Suburb).

In Canada: Crane Packing Co., Ltd. 617 Parkdale Avenue, Hamilton, Ontario.

## Free data

These 3 booklets on *Production Lapping* and *Light Band Reading* are yours for the asking. Write today.



Model 12 handles 3  
4-in. dia. parts up to 705  
1/4-in. dia. parts per load.



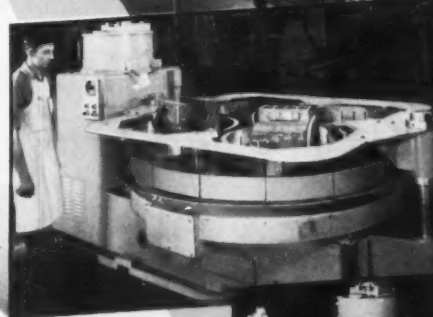
Model 24 handles 3  
9 1/2-in. dia. parts up to 3900  
1/4-in. dia. parts per load.



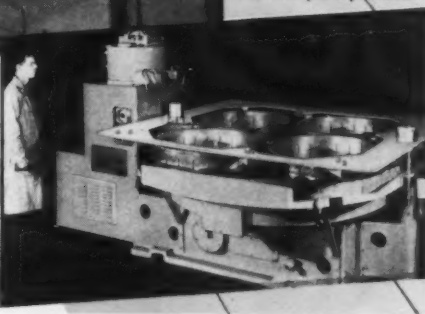
Model 36 handles 4  
13 3/4-in. dia. parts up to 4000  
3/8-in. dia. parts per load.



Model 48 handles 4  
17-in. dia. parts up to 940  
1-in. dia. parts per load.



Model 72 handles 4  
27-in. dia. parts up to 2480  
1-in. dia. parts per load.



Model 84 handles 4  
32-in. dia. parts up to 3500  
1-in. dia. parts per load.



MECHANICAL PACKINGS



SHAFT SEALS



TEFLON PRODUCTS



LAPPING MACHINES



THREAD COMPOUNDS

**CRANE PACKING COMPANY**

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—271

## Obituaries

GEORGE E. HALLENBECK, retired chairman of the board of Baker Brothers, Inc., Toledo, Ohio, died on May 27 at the age of seventy-eight years. Mr. Hallenbeck was with Baker Brothers for fifty-seven years, retiring a year ago. He was named president in 1939 and was elected chairman of the board in 1947. He was graduated from Purdue University in 1900 with a bachelor of science degree in mechanical engi-

neering. A pioneer inventor of automotive production machinery, he held a number of patents in the machine tool field. He is survived by a son, Thomas; a daughter, Mrs. William Bemis; two sisters, Mrs. Ruth Mapes and Harriet Hallenbeck; and four grandchildren.

JOHN L. SLADE, administrative assistant to the vice-president of the Black & Decker Mfg. Co., Towson, Md., died on June 1 at the age of thirty-three. Mr. Slade had served as manager of the company's Hampstead plant until 1954.

## Film on Making Carbide Tools

The manufacture of Carmet carbide tools—from powder to finished form—is the subject of a 16-millimeter color film recently completed by the Allegheny Ludlum Steel Corporation. The film has a running time of twenty-seven minutes and is directed toward high school and college groups, as well as machinists and supervisory personnel. Prints may be obtained by writing to the Sales Department, Allegheny Ludlum Steel Corporation, 2020 Oliver Building, Pittsburgh 22, Pa.

## Contouring Tapered Sections by Radial Draw-Forming

Parts that either taper from one end to the other or vary in cross-sectional area throughout the piece are now being successfully contour-formed in a single operation. Conventional forming methods are not used because the tonnage necessary to set the contour of the heavier sections would very likely fracture or overstress the lighter areas. It often has been necessary to create long tapered sections by joining several shorter pieces or by machining the taper after the contour has been set.

New techniques are incorporated in the illustrated radial draw-forming machine manufactured by the Cyril Bath Co., Solon, Ohio. Among

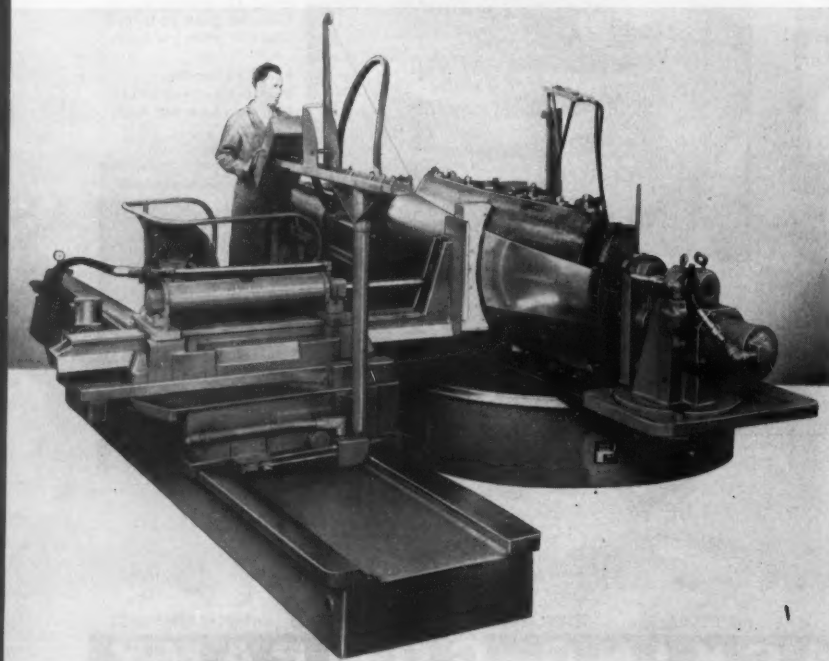
the working members of the machine are a tension cylinder and a contour die mounted on a rotary table, and also a traverse compression unit that includes a hydraulic ram with wiping shoes to iron the material against the face of the contour die.

One way in which the machine can be used involves stretch-forming the work-piece contour at tonnages suitable for the lighter cross-sectional area of the material. At the same time, the hydraulic ram unit exerts pressure at the point of tangency of the material and the contour die and progressively increases the pressure to accurately form the

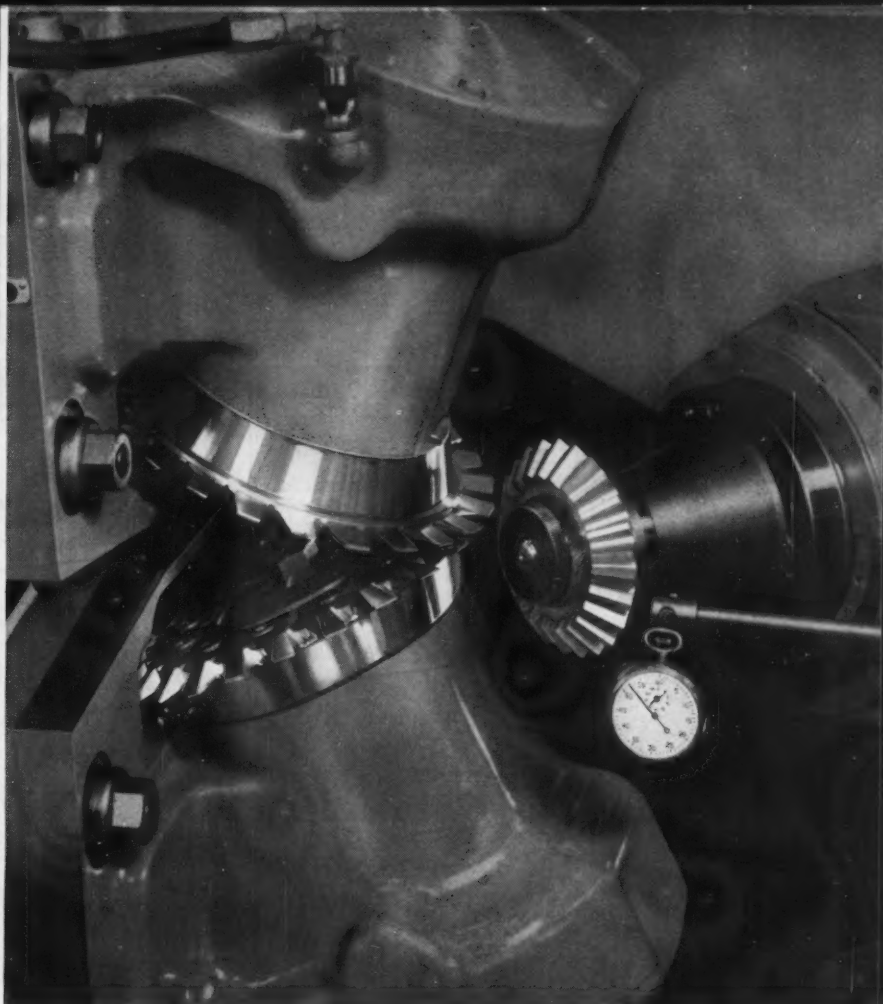
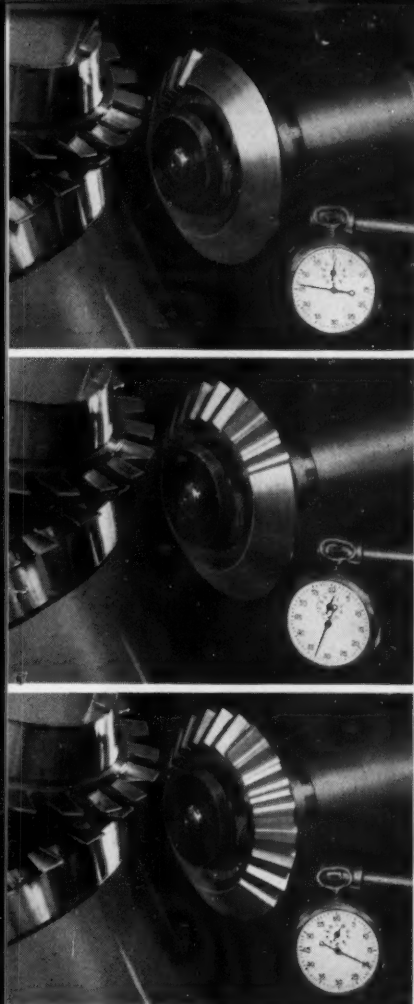
heavier cross-sectional areas. Thus, both stretch and compression methods of metal forming are used simultaneously. Pieces are shaped accurately and further machining is virtually eliminated.

A second technique employs the hydraulic ram unit as an additional gripper. The wiping shoe is provided with a rubber-backed contact face so that, under pressure, it will be self-adjusting to the contour of the die at any point. First, the lighter section of the piece is set to its proper contour under the application of a relatively small stretching load. The wiping shoe on the ram is then brought into contact with the material at a point along the part contour and sufficiently forces it against the die to act as an additional gripper. After that, stretching tonnages may be increased to set the heavier areas of the piece. This relocation of the holding shoe and increase in the stretching tonnage may be repeated several times in the case of long parts.

To form tapered sheets of more complex contours, the machine can be used with specially designed pressure shoes consisting of a flexible wiping face backed up by a series of shoe segments. Each of the shoe segments is hydraulically powered and is connected so as to flex the wiping face to any desired contour. Both of the described techniques may be used to form sheets, extrusions, or other types of sections.



Radial draw-forming machine is used to shape the contour of parts that are tapered or have a varying cross-section. A hydraulically backed wiper sets the stretched part to the contour of the die-block.



## 3 minutes-52 seconds, completed from the solid *you can cut gears 5 times faster!*

You can increase production by as much as 400%.

Your exact gain may vary with different gears, but in most cases this new generator will complete five gears in the time earlier models cut just one. The illustrations above show a 6 DP, 25 tooth,  $\frac{7}{8}$ " face width, straight bevel gear completed from the solid blank.

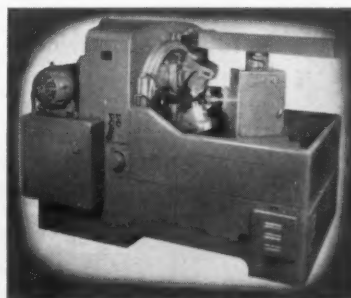
The No. 104 Straight Bevel Coniflex\* Generator completes each tooth in one rapid operation. A pair of

\*Coniflex® straight bevel gears with localized tooth bearings.

multi-blade disc-type cutters combined with a cam-controlled machine cycle insures high efficiency, fine finish and maximum cutter life.

Easy to set up, the No. 104 has a wide range of capacity. You'll get the same excellent results for both small quantity jobbing work and volume production.

To discover other savings you can make with this remarkable Gleason Generator, simply write for descriptive bulletin.



*The Gleason No. 104 Straight Bevel Coniflex Generator cuts gears up to 8½" diameter, 4½" cone distance and 1½" face width, from 20 to 3 DP, ratios up to 10 to 1.*



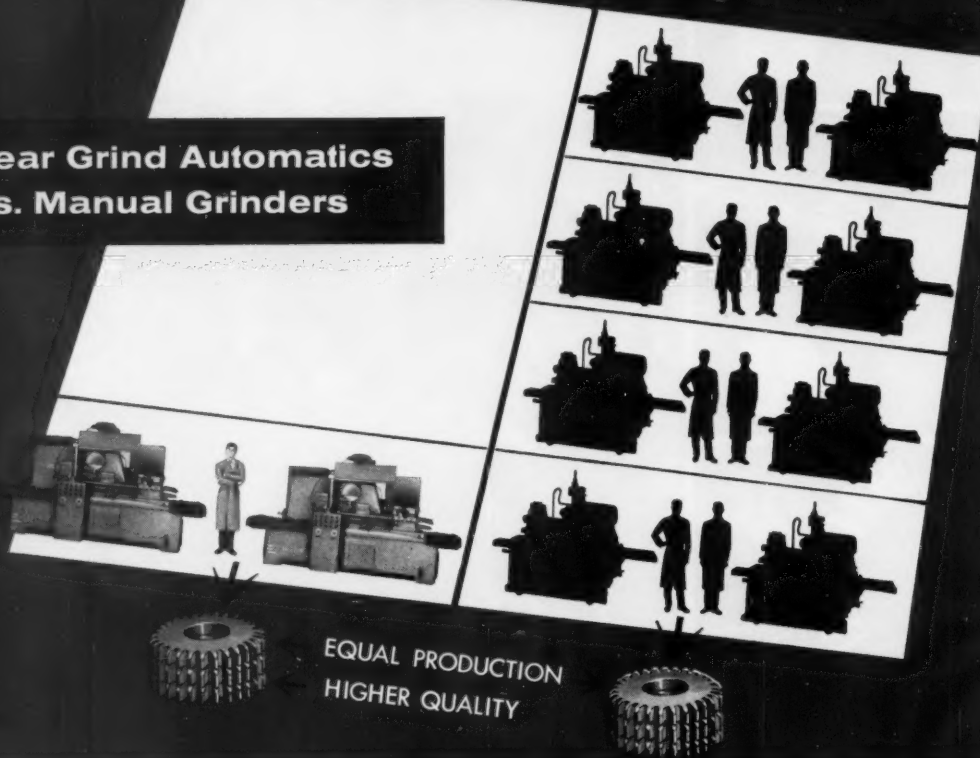
# GLEASON WORKS

*Builders of bevel gear machinery for over 90 years*

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

# Here's real grinding economy!

## Gear Grind Automatics Vs. Manual Grinders

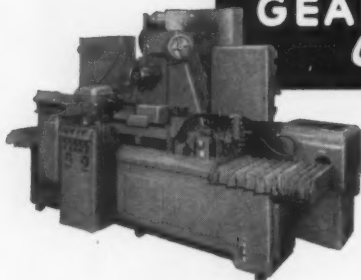


**2 Automatics with 1 Operator Equals  
8 Manuals with 8 Skilled Operators**

$\frac{1}{4}$  the floor space  
 $\frac{1}{4}$  the number of machines  
 $\frac{1}{8}$  the manpower

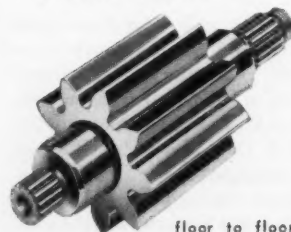
Gear  
Grinding  
Economy

**GEARGRIND**  
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**PUMP  
ROTORS**  
600 pcs./8 hrs./ma-  
chine

**PUMP GEAR**



floor to floor  
grinding cycle—  
6 minutes

For all the facts—write today!

**THE GEAR GRINDING MACHINE COMPANY**

3921 Christopher, Detroit 11, Michigan

Manufacturers of:

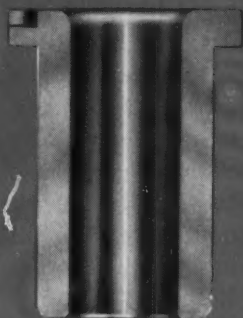
The Detroit Screwmatic 750, Automatic Screw Machine.  
RZEPPA ("Sheppa") Constant Velocity Universal Joints



for accuracy in your production  
it pays to specify

## UNIVERSAL DRILL BUSHINGS

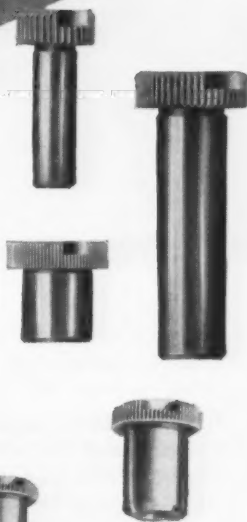
In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.



superfinish bores  
lengthen tool life

The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.

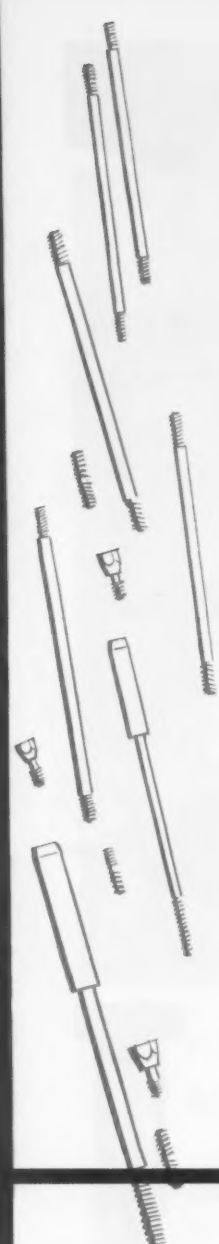
Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.



Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

### UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2,  
MICHIGAN



## **STANOIL Industrial Oil delivers on tough assignment at Indianapolis Screw Products Corp.**

Rolling threads on aluminum bronze with pitch diameter tolerances as close as .0014" is a tough job but Indianapolis Screw Products Corporation is used to taking on such jobs and delivering. They give tough jobs to the hydraulic oil they use, too, and they expect it to deliver. They've given such a job to STANOIL and they're getting the results they expect—and more.

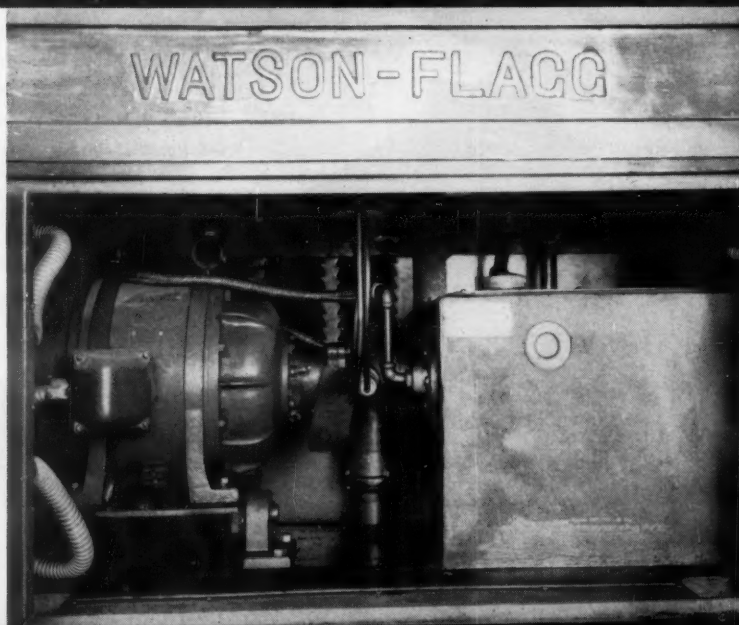
**STANOIL** Industrial Oil is used in the hydraulic system of a Watson-Flagg precision thread roller in the Indianapolis Screw Products Corporation plant. The system uses a Vickers pump and Cuno filter. The filter has not been cleaned in over a year *because it hasn't*

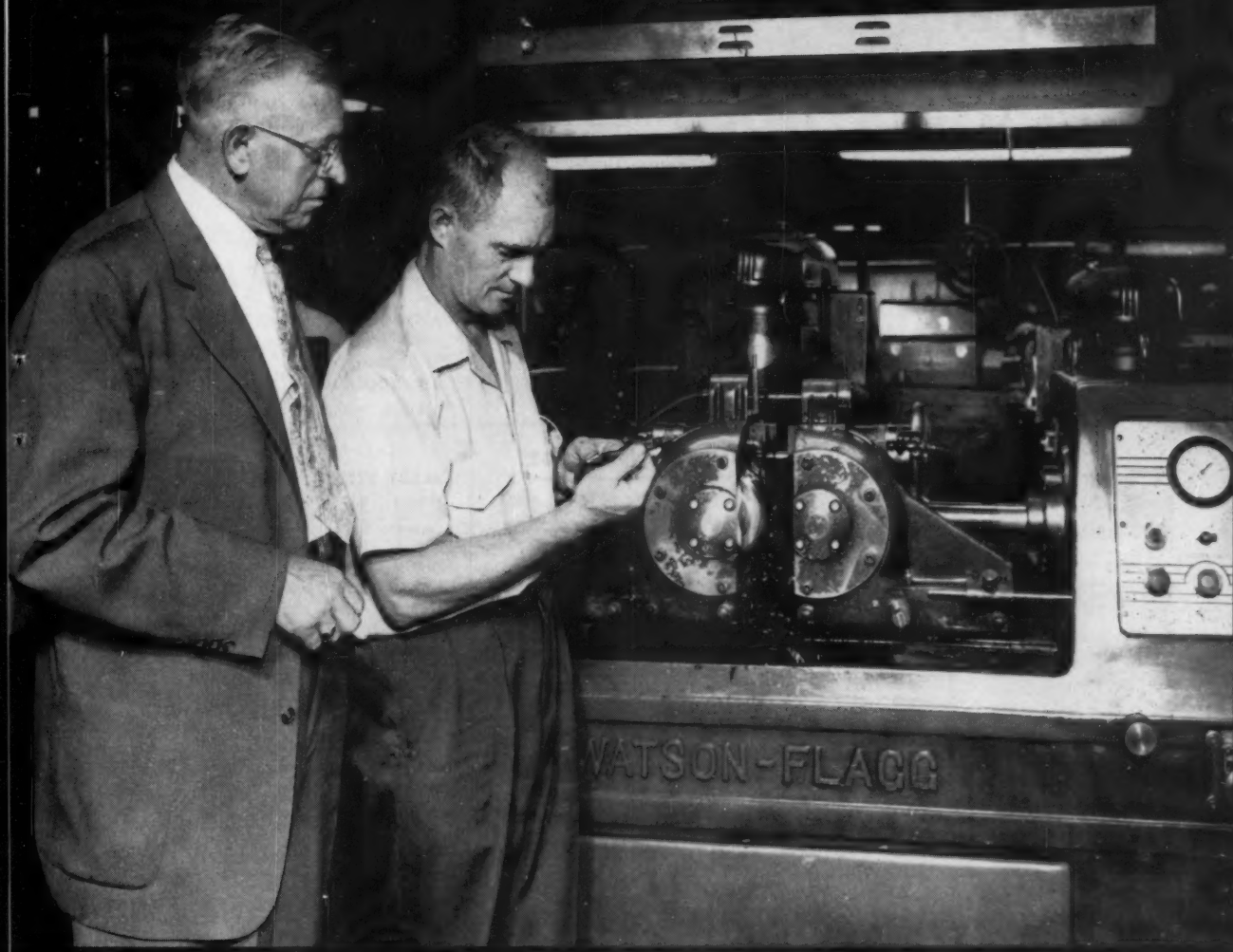
*needed cleaning.* Here, as in other applications, STANOIL delivers top performance with minimum maintenance and maximum system cleanliness.

**STANOIL** likes tough assignments like this one; likes them because it can deliver with plenty to spare.

Perhaps you would like to know about the use of STANOIL in a hydraulic application in your plant. In the Midwest and Rocky Mountain states, a lubrication specialist at your nearby Standard Oil office will be happy to discuss it with you. Call him. Or, if you would like, contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Tight gaskets, good maintenance, and STANOIL add up to first rate performance at Indianapolis Screw Products Corporation. This shot of Vickers pump shows how good housekeeping and STANOIL team for top operation on tough assignment.





Cuno filter in Watson-Flagg Thread Roll machine has filtered STANOIL more than a year. Filter remains clean.

Mr. R. W. Williams, Plant Superintendent, checks pitch diameter of thread with Glenn Riggs, Standard lubrication specialist. Glenn Riggs is an old hand at helping industrial firms work out lubrication problems. Glenn has been doing this sort of thing for 28 of the 30 years he's been with Standard. This background and experience, customers have found, pay off for them.



**STANDARD OIL COMPANY**  
(Indiana)

# Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

## ABRASIVE CLOTH, Paper and Belt

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

## ABRASIVES

See Discs, abrasive

## ABRASIVES, HONING

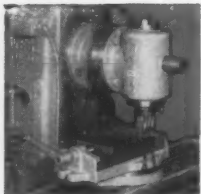
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

## ABRASIVES, Polishing, Tumbling, Etc.

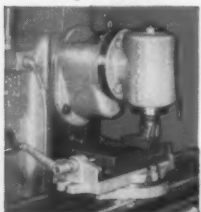
Norton Co., 1 New Bond St., Worcester 6, Mass.  
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

## ACCUMULATORS, Hydraulic

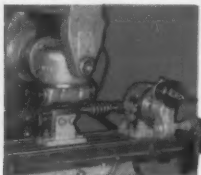
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.  
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.



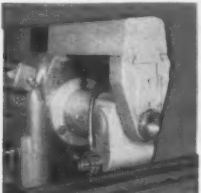
Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment

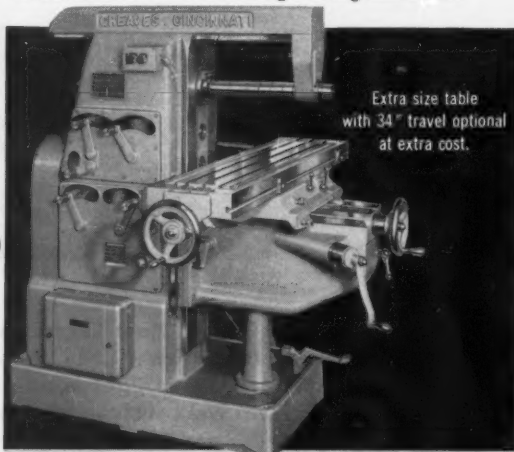


Rack Milling Attachment

## Heavy duty attachments increase versatility of dependable, low-cost **GREAVES MILLS**

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS. Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.



Extra size table  
with 34" travel optional  
at extra cost.

**GREAVES MACHINE TOOL CO.**  
25 Eastern Avenue, Cincinnati 2, Ohio

Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.  
Send information on Attachments and Accessories for GREAVES MILLS.

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**FREE** Comparison  
Chart and detailed  
descriptive literature  
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**AIR TOOLS**—See Grinders, Pneumatic;  
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## ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., Reading, Pa.  
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.  
Vanadium Alloys Steel Co., Latrobe, Pa.  
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

## ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York.  
Bridgeport Brass Co., Bridgeport, Conn.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
Mueller Brass Co., Port Huron 35, Mich.  
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

## ALLOYS, Zinc

New Jersey Zinc Co., 160 Front St., New York, N. Y.

## ARBOR PRESSES

See Presses, Arbor

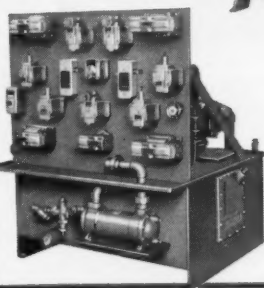
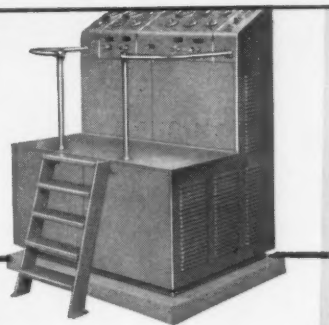
## ARBORS AND MANDRELS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.  
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.  
Jacobs Mfg. Co., West Hartford, Conn.  
Kempsmith Machine Co., Milwaukee, Wis.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Shenango-Penn Mold Co., Dover, Ohio.  
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

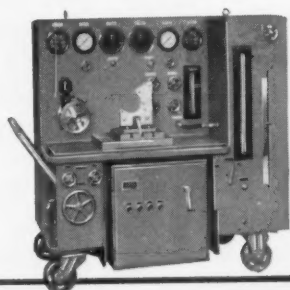
(Continued on page 282)



Pulpit type power unit provides full visibility, easy accessibility.

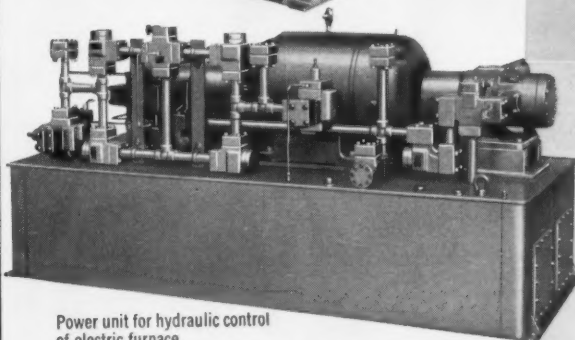
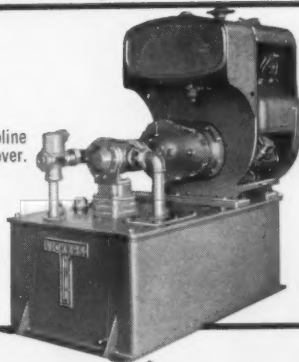


Compact power unit showing gasket-mounted valves.



Portable power unit for testing pumps.

Power unit with gasoline engine as prime mover.



Power unit for hydraulic control of electric furnace.

6837

Individually Designed  
to Meet *SPECIFIC* Needs

# VICKERS® Custom Built HYDRAULIC POWER UNITS

DEPENDABLE PERFORMANCE

IMPROVE AND SIMPLIFY DESIGN

REDUCE INSTALLATION  
COST AND TIME

EASIER SERVICING

BETTER APPEARANCE

Vickers engineers approach the design of a custom-built hydraulic power unit from the standpoint of the customer's **INDIVIDUAL** needs. The sole objective is to meet HIS requirements with the best hydraulic "package". This assures the most compact, efficient and convenient hydraulic equipment for the particular machine.

A Vickers Hydraulic Power Unit includes all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., as well as all hydraulic accessories (oil filters, air cleaners, oil level gauges, fittings, etc.). Hydraulic connections can be grouped in a convenient manifold.

In addition to the advantages mentioned above, each Unit is pretested at the factory and ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is also an important feature to both the machine builder and his customer. Write for Bulletin 52-45.

## VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE AND ENGINEERING CENTER

Department 1403 • Detroit 32, Michigan

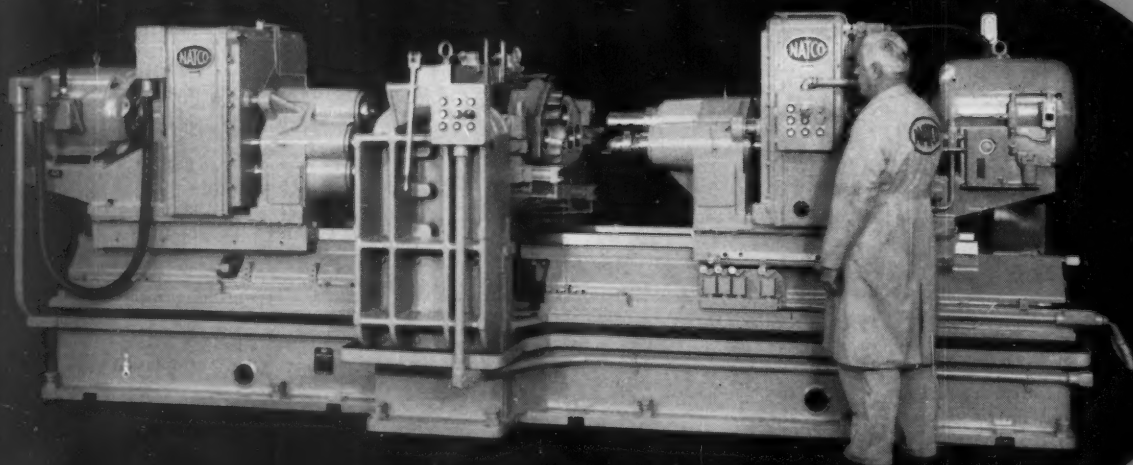
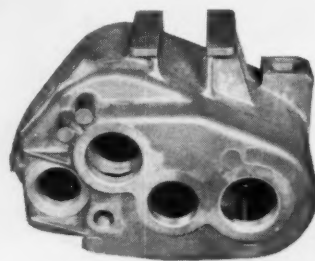
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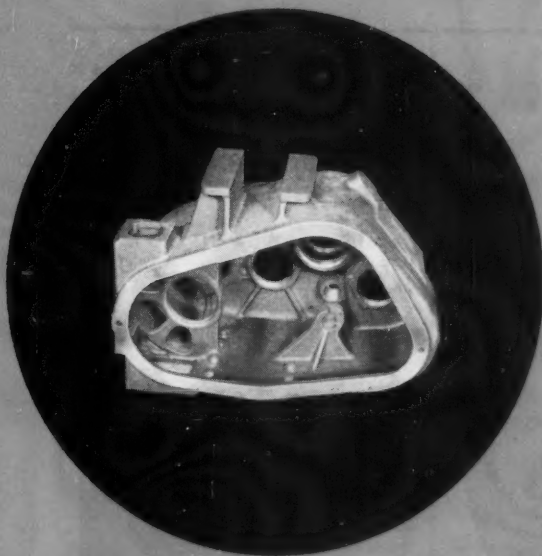
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

# **Natco<sup>®</sup>** **Automatic** **Matches** **Boring Mill** **Accuracy**

*and quickly converts for five different jobs*





This Natco two-way machine stepped in where automatics "fear to tread!" It replaced a precision boring mill, speeded production and didn't give up a tenth in accuracy! At The Frank G. Hough Co. boring mills were used for exacting tolerances on transmission parts for the Hough Payloader®. Higher production was desired.

Now with a Natco two-way automatic, Hough is getting production rates—not job shop rates. The Natco bores diameters to within .0005"—square with mounting face within .0005" per inch bore length. The machine also chamfers, counterbores and notches boss contours.

Versatile too! Hough processes five different transmission housings or covers with a single machine. After a typical production run averaging 100 parts, the machine is quickly converted to another job.

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

## National Automatic Tool Company, Inc. *Richmond, Indiana*

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

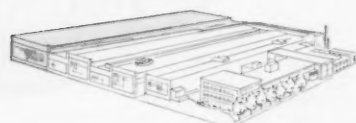
Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.



## Notes from Natco...

### Middle Age Spread

Having reached the age of 55 feeling as spry as the day we started, we at Natco are going to spread out. The demand for our products makes this necessary since we're anxious to give our customers the kind of deliveries they need.



After Jan. 1, 1957, when the job is finished, we'll have eight acres under one roof at our Richmond, Indiana plant. We figure it will increase our production capacity about 50%.

To take care of the increased need for Sales Service, we've already increased our staff about 50% and provided them with new efficient quarters.



### Appreciating Depreciation

Depreciation, we've come to realize, is one of the least understood and most important aspects of the business picture today. Though we're far from experts on the ins and outs of this complex subject, we've undertaken to discuss the importance of looking at depreciation realistically in our current FORTUNE campaign. We'll be happy to send you reprints if you'll drop us a line.

# AMES

*Long Range  
Dial  
Indicators*

Check Motions or Dimensions  
In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:—dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications—your answer will be back faster if you do.

*Representatives in principal cities*



## B.C. AMES CO.

27 Ames Street, Waltham 54, Mass.

MANUFACTURER OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

### BABBITT

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

### BALANCING EQUIPMENT

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.  
Casa Corp., 405 Lexington Ave., New York 17.  
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
Pope Machinery Corp., Haverhill, Mass.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.  
Thor Power Tool Co., Aurora, Illinois

### BALLS

Kennametal, Inc., Latrobe, Pa.

### BARs, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Shenango-Penn Mold Co., Dover, Ohio

### BARs, Steel

Allegheny Ludlum Steel Corp., Bethlehem, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., Reading, Pa.  
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
Timken Roller Bearing Co., Canton, Ohio.  
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.  
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

### BEARINGS, BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

### BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Fafnir Bearing Co., New Britain, Conn.  
Federal Bearings Co., Inc., Poughkeepsie, New York.  
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.  
New Departure Div., General Motors, Bristol, Conn.  
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.  
Norma-Hoffman Bearings Corp., Stamford, Conn.

### BEARINGS, Bronze and Special Alloy

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
Shenango-Penn Mold Co., Dover, Ohio.

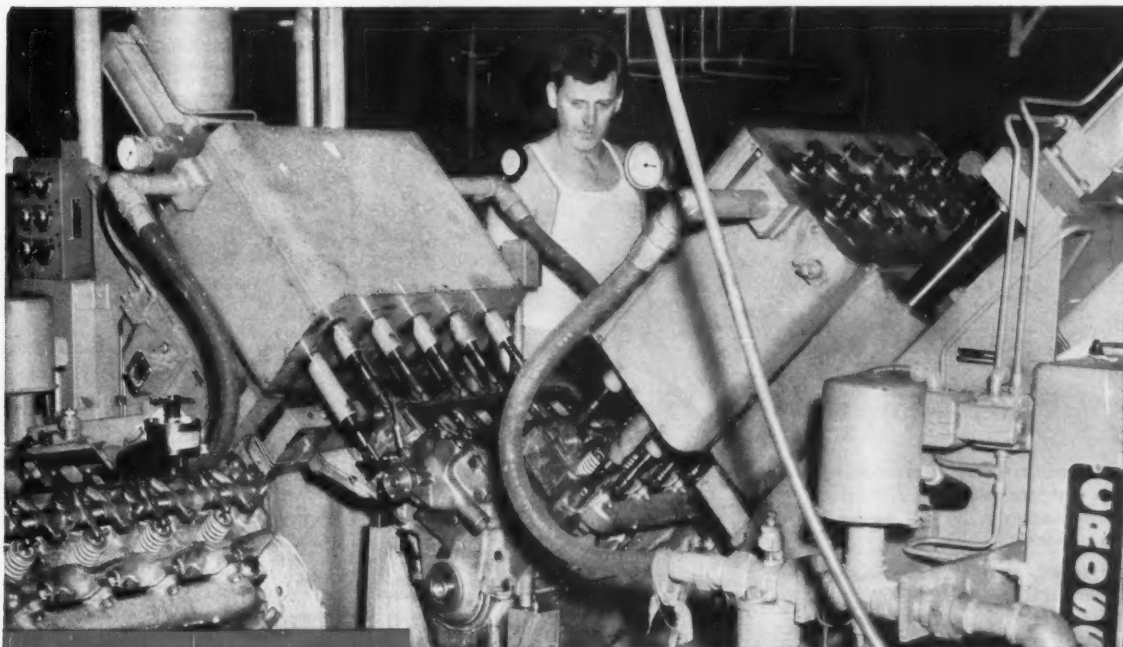
### BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.  
Orange Roller Bearing Co., Inc., Orange, N. J.  
Standard Pressed Steel Co., Jenkintown, Pa.

(Continued on page 284)

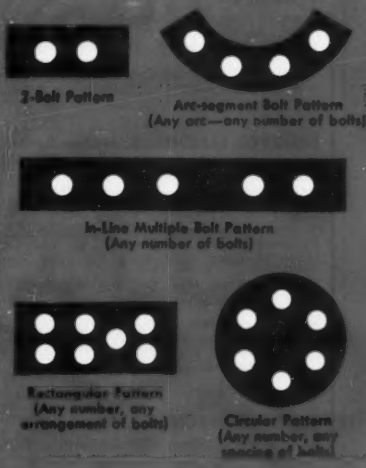


# Thor Automation Tools on your job can make big cuts in labor costs



Almost unlimited applications—a typical example is this Thor 22 unit multiple nutsetter used on line of leading car manufacturer's Detroit plant

**Thor multiple tools  
can be custom-built to  
any pattern, any number**



## Thor features assure better jobs at less cost

**STALL-TYPE**, rigid air regulation permits driving of each nut to exact predetermined tension.

Exclusive quick-change mounting in master manifold permits 30 second change-over of individual units for inspection or replacement.

Easier to operate. Multiples eliminate torque reaction at moment nuts are seated.

Air operated plunger-type push-off rods for automatic disengagement.

Various nut heights on one job handled by axially slidable socket driving spindles.

Available in complete range of sizes for any power tool assembly opera-

tion in straight, offset or angle models.

Free design service. Thor will design and quote on a multiple nutsetter job for you without obligation on your part. For further information contact your Thor branch in the city shown below or write Thor Sales Engineering Dept., Thor Power Tool Company, Aurora, Illinois.



### THOR POWER TOOL COMPANY • AURORA, ILLINOIS

Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit  
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For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—283

**ALL ENDS OF PARTS**  
*Completely Finished*  
**"1·2·3"**  
 ON THE  
**GOSS and DeLEEuw**  
*Automatic Chucking Machine*  
 in **1 SET-UP**

This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding achievement.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

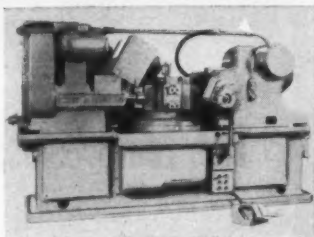
Easy, fast change-over from job to job make this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.



Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

**GOSS and DeLEEuw**  
 MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



#### BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

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Ball & Roller Bearing Co., Danbury, Conn.  
 Fafnir Bearing Co., New Britain, Conn.  
 Marlin-Rockwell Corp., 402 Chandler Bldg.,  
 Jamestown, N. Y.  
 Norma-Hoffman Bearings Corp., Stamford,  
 Conn.  
 Orange Roller Bearing Co., Inc., Orange, N. J.  
 Rollway Bearings Co., Inc., 541 Seymour St.,  
 Syracuse, N. Y.  
 Timken Roller Bearing Co., Canton, Ohio.

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American Crucible Products Co., 1395 Oberlin  
 Ave., Lorain, Ohio  
 Boston Gear Works, 3200 Main St., North  
 Quincy, Mass.  
 Bunting Brass & Bronze Co., Spencer and Car-  
 lton Aves., Toledo, Ohio.

#### BEARINGS, Tapered Roller

Timken Roller Bearing Co., Canton, Ohio.

#### BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.  
 Bunting Brass & Bronze Co., Spencer and Car-  
 lton Aves., Toledo, Ohio.  
 Fafnir Bearing Co., New Britain, Conn.  
 General Electric Co., Schenectady, N. Y.  
 Marlin-Rockwell Corp., 402 Chandler Bldg.,  
 Jamestown, N. Y.  
 Nice Ball Bearing Co., Nicetown, Philadelphia,  
 Pa.  
 Norma-Hoffman Bearings Corp., Stamford,  
 Conn.  
 Orange Roller Bearing Co., Inc., Orange, N. J.  
 Rollway Bearing Co., Inc., Syracuse, N. Y.  
 Shear-Penn Mold Co., Dover, Ohio.  
 Timken Roller Bearing Co., Canton, Ohio.

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Standard Pressed Steel Co., Jenkintown, Pa.

#### BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave.,  
 Philadelphia, Pa.

#### BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

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 Rd., Rochester, N. Y.  
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
 Ill.  
 Verson Allsteel Press Co., 93rd St. & S. Ken-  
 wood Ave., Chicago, Ill.

#### BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div.,  
 Philadelphia 42, Pa.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Buffalo Forge Co., 490 Broadway, Buffalo,  
 N. Y.  
 Chambersburg Engrg. Co., Chambersburg, Pa.  
 Farquhar, A. B., Div. Oliver Corp., York, Pa.  
 Hannifin Corp., 501 Wolf Rd., Des Plaines,  
 Ill.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
 Lake Erie Engrg. Corp., Kenmore Sta., Buffalo,  
 N. Y.  
 Niagara Machine & Tool Works, 683 North-  
 land Ave., Buffalo, N. Y.  
 Verson Allsteel Press Co., 93rd St. & S. Ken-  
 wood Ave., Chicago, Ill.

#### BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo,  
 N. Y.  
 Farquhar, A. B., Div. Oliver Corp., York, Pa.

#### BLAST CLEANING EQUIPMENT

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 Detroit 4, Mich.  
 Pangborn Corp., Hagerstown, Md.  
 Walls Sales Corp., 333 Nassau Ave., Brooklyn  
 22, N. Y.

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U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Landis Machine Co., Inc., Waynesboro, Pa.  
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

**BOLTS AND NUTS**

Bethlehem Steel Co., Bethlehem, Pa.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Ottemiller, W. H., & Co., York, Pa.  
Russell, Burdall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

**BOOKS, Technical**

Industrial Press, 93 Worth St., New York 13, N. Y.  
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

**BORING AND DRILLING MACHINES**

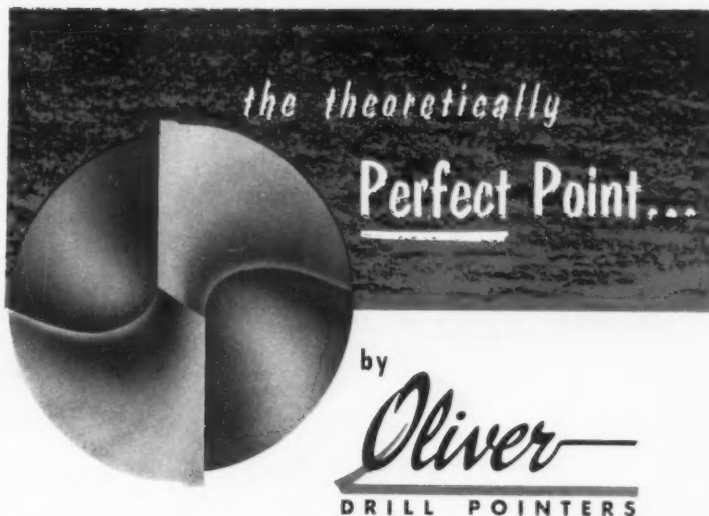
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Crosby Co., 3250 Bellevue, Detroit 7, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.  
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Wales-Strippet Corp., North Tonawanda, N. Y.

**BORING AND TURNING MILLS, Vertical**

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

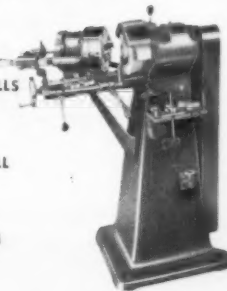
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# ACHIEVED!



The Model 510 Oliver Drill Pointer will provide these advantages . . .

- A THEORETICALLY PERFECT POINT WITH INCREASED CLEARANCE AT THE WEB OF THE DRILL PERMITS FASTER AND EASIER PENETRATION.
- SHARPENS 2, 3 AND 4 FLUTE DRILLS, RIGHT HAND SPIRAL. (GEARING FOR LEFT HAND DRILLS AVAILABLE AT EXTRA COST.)
- VARIABLE CLEARANCES FOR ALL DRILLING CONDITIONS.
- INCLUDED POINT ANGLES FROM 82° TO 160°.
- ¼" TO 3" DIAMETER CAPACITY.
- AVAILABLE FOR EITHER WET OR DRY GRINDING.



## PROOF?

Send a few drills to Oliver to be repointed at no cost . . . use them . . . then buy Oliver.

No. 21 Bench Model Pointers and Oliver Point Thinning Machines are also supplied.

# Oliver

INSTRUMENT •  
• COMPANY

1410 EAST MAUMEE



ADRIAN, MICHIGAN

FACE MILL GRINDERS • AUTOMATIC DRILL GRINDERS • DIE MAKING MACHINES  
TOOL & CUTTER GRINDERS • DRILL POINT THINNERS • TEMPLATE TOOL GRINDERS

# The WIEDEMANN METHOD *Cuts Piercing Costs* **60 to 90%**

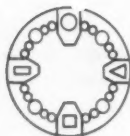
Because ONLY a WIEDEMANN combines:



## A Punch Press

(PIERCING SPEED)

+



## Punches and Dies in Turrets

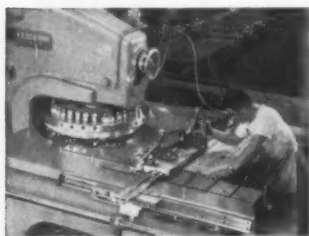
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## Work Locating Gauge

(NO LAYOUT)



Capacities from 7-1/2 to 150 Tons  
Throat depths from 12" to 60"

- INCREASED  
PRODUCTION
- REDUCED COST
- MAXIMUM  
FLEXIBILITY

Get the facts—send drawings of your work for a  
free time study or write for Bulletin 101.

# WIEDEMANN MACHINE COMPANY

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Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

## BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.  
Cosa Corp., 405 Lexington Ave., New York 17.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Espin-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.  
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.  
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.  
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

## BORING HEADS

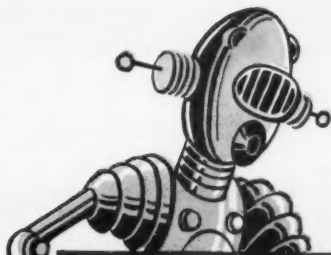
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Mummert-Dixon Co., Hanover, Pa.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

## BORING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bryant Chucking Grinder Co., Springfield, Vt.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
National Automatic Tool Co., Inc., S. 7th and N. 5th, Richmond, Ind.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(Continued on page 290)



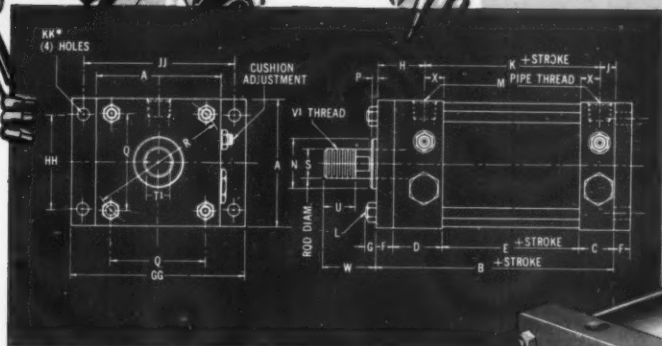


# FOR AUTOMATION

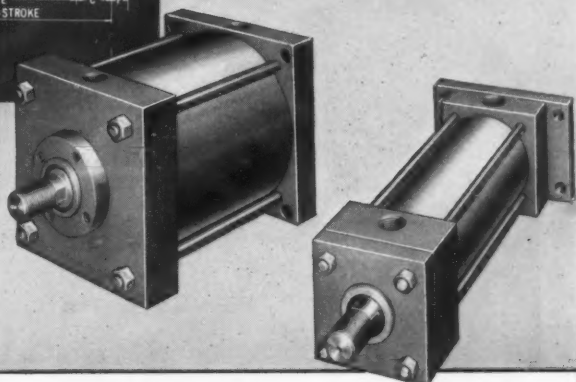
# IT'S

# Logan

## AIR AND HYDRAULIC FLUID POWER EQUIPMENT



### LOGANSQUARE NONROTATING DOUBLE-ACTING CYLINDERS



Bore	A	B	C	D	E	F	G	H	J	K	L	M	N +0.000 -0.003	P	Q ±.005	R	S	T <sup>1</sup>	U	V <sup>1</sup>	W	X	GG	HH	JJ	KK	AD	AE
1½	2	4	1	1½	1½	¾	¾	1½	¾	2½	¾-28	¾	1¾	¾	1.458	2½	¾	¾	¾	¾-18	1¾	¾	3¾	1¾	2¾	¾	—	—
2	2½	4	1	1½	1½	¾	¾	1½	¾	2½	¾-24	¾	1¾	¾	1.856	2½	¾	¾	¾	¾-18	1¾	¾	4¾	1¾	3¾	¾	—	—
2½	3	4½	1	1½	1½	¾	¾	1½	¾	2½	¾-24	¾	1¾	¾	2.209	3½	¾	¾	¾	¾-18	1¾	¾	4¾	2¾	3¾	¾	—	—
3	3¾	5	1½	1½	1½	¾	¾	1½	¾	2½	¾-24	¾	1¾	¾	2.651	3¾	1	¾	1½	1-14	1¾	1½	5½	2¾	4½	¾	—	—
4	4½	5½	1½	1½	1½	¾	¾	1½	¾	3	¾-24	¾	1¾	¾	3.402	4½	1	¾	1½	1-14	1¾	1½	6¾	3¾	5¾	¾	—	—
5	5½	5½	1½	1½	1½	¾	¾	1½	¾	3½	¾-20	¾	2	¾	4.154	5¾	1¾	¾	1½	1-14	1¾	1½	7¾	4¾	6¾	¾	—	—
6	6½	6½	1½	2	2	¾	¾	1½	¾	3½	¾-20	¾	2	¾	4.993	7½	1¾	1¾	1½	1½-12	2½	1½	8¾	4¾	7¾	¾	—	—
8	8½	6½	1½	2	2	¾	¾	1½	¾	3½	¾-18	¾	2½	¾	6.452	9¾	1¾	1¾	1½	1½-12	2½	1½	—	7¾	—	1½	4¾	10¾

Dimensions apply to no-stroke assemblies. Pipe thread is American (National) "Dryseal." Dimensions for cushioned and noncushioned are identical. All dimensions are given in inches. \*Use bolts 1/16 smaller than "KK" (mounting holes).

Broad selection of mountings and mounting combinations. Pressures up to 150 psi air; up to 500 psi oil.



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AIR AND HYDRAULIC EQUIPMENT

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PROPERLY DESIGNED — PROPERLY EQUIPPED

LOGANSPORT MACHINE CO., INC.

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PLEASE SEND COPY OF CATALOG:

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| <input type="checkbox"/> 100-3 AIR-DRAULIC CYLINDERS   | <input type="checkbox"/> 200-3 750 SERIES HYD. CYLINDERS |
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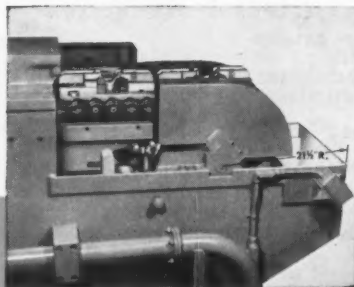
# NEW

## DETROIT Continuous

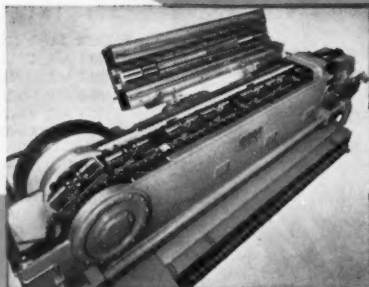
**BULL GEAR  
1/2 TON**

**BROACH TUNNEL  
13/4 TONS**

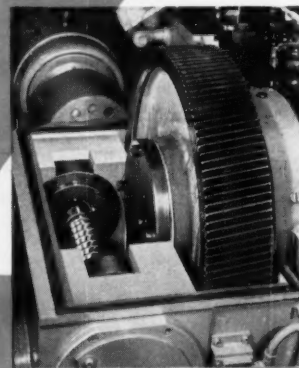
**MACHINE  
17 1/2 TONS**



Note generous radius from chain axis to outer machine frame, 22 1/2" at loading end, 23 1/2" at unloading end. This assures easy, safe handling of wide variety of work sizes and shapes.



Broach tunnel raised to show heavy duty twin chain type drive and automatic hammer lock fixtures. Tunnel and broaches weigh 3,750 lbs., while entire machine weighs 35,000 lbs.



Massive 1/2 ton bull gear provides positive pulling power and smooth operation required for extremely fine finishes. Gear is directly connected to main drive drum.

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## Horizontal Machine

**WEIGHT** *where you want it!*

**ROOM** *where you need it!*

Extreme weight and rigidity are the answers to high-production surface broaching with fine work finishes and long tool life . . . and this husky new Detroit Continuous Horizontal gives you the most you can get!

### PLUS

- Generous loading and unloading clearances for easy, safe handling of a wide variety of work.
- All-welded, heavy steel plate frame.
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- Safety interlock assures proper work positioning before operation.
- Heavy-duty, twin chain electric-mechanical drive.
- Simple change gears for varied cutting speeds.
- Entirely self-contained, including automatic chip disposal unit.
- Electric and hydraulic equipment to J.I.C. standards.

*Model illustrated is 90" stroke 15-ton capacity with cutting speeds to 40 f.p.m. Other 15-ton models available with 66" and 120" stroke, lower and higher tonnage capacities on request. Send part prints for prompt recommendation and quotation, or mail coupon now for free descriptive literature.*

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DEPT. B-7

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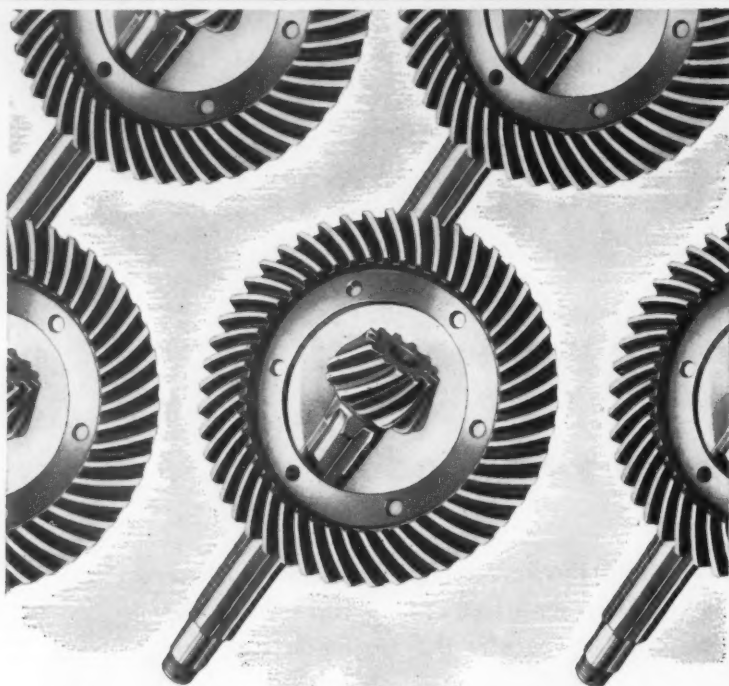
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**SAVES YOU MORE ON TOP-QUALITY GEARS**

*Fine Gears  
Made to Order*  
for all manner of  
industrial equipment

SPIRAL BEVEL  
STRAIGHT BEVEL  
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WORMS AND WORM GEARS

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Fairfield is famous for repeat orders—and simply because quality is consistently high, and price is—well, just try to beat it!

How can Fairfield manage this unique position year after year? Truth is, it involves some tried-and-true mass-production methods plus some very special Fairfield ideas developed in the past 35 years of precision gear making.

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American Sjp Corp., 100 E. 42nd St., New York 17, N. Y.  
Cincinnati Bickford Tool Co., 3220 Farrer Ave., Cincinnati, Ohio.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.  
Pratt & Whitney, West Hartford 1, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.  
Wales-Strippet Corp., North Tonawanda, N. Y.

## BORING TOOLS

Apex Tool & Cutter Co., Inc., 237 Canal St. Shelton, Conn.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
Kennametal, Inc., Latrobe, Pa.  
Metal Carbides Corp., Youngstown, Ohio.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio  
Bliss, E. W. Co., 1375 Raff Road, S. W. Canton, Ohio.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.  
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.  
Ferracute Machine Co., Bridgeton, N. J.  
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

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Mueller Brass Co., Port Huron 35, Mich.  
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Detroit Broach Co., Detroit, Mich.  
duMont Corp., Greenfield, Mass.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Zogor Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

## BROACHING MACHINE

American Broach & Mch. Co., Ann Arbor, Mich.  
Cincinnati Milling Mch. Co., Cincinnati, Ohio.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Detroit Broach Co., P. O. Box 156, Rochester, Mich.  
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

(Continued on page 292)



# Now—"A" Grade Gage Blocks at "B" Grade Prices



**81 Piece Grade A  
Rectangular Set**  
Now Only **\$395**



**GRADE A  
Guaranteed  
+ .000004"  
- .000002"**



**81 Piece Grade A  
Square Block Set**  
Now Only **\$465**

**Closer Tolerances . . . Superior Finish . . . Longer Life . . . Lower Cost**

## New Standards for DoALL Gage Blocks

Grade	Tolerance per Inch of Length	Flatness	Parallelism	Surface Finish Microinches RMS
"AAA"	+ .000001 - .000001	.000001	.000001	0.09
"AA"	+ .000002 - .000002	.000002	.000002	0.09
"A" *	+ .000004 - .000002	.000004	.000004	0.09

\*Grade B blocks discontinued—  
replaced by Grade A at comparable prices.

## New Literature Free on Request

New Gage Block Catalog and Price List—  
contains complete data on DoALL rectangular and square block sets . . . and  
block accessories for assembling fixed  
and indicating gages for every re-  
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Call or write DoALL for your copy  
—no obligation.



CB-17



MACHINE TOOLS . . . . . CUTTING TOOLS . . . . . GAGES . . . . . GRANITE PLATES . . . . . TOOL STEEL

DoALL has met modern measurement needs with a sweeping change in gage block standards. Grade B blocks ( $\pm .000008"$ ) have been discontinued . . . replaced by Grade A at an almost identical price! And, Grade A now has a minus .000002" tolerance, formerly minus .000004", providing greater accuracy and a two-millionths cushion for wear.

Grade AA blocks ( $\pm .000002"$ ) are now priced only slightly higher than former Grade A prices.

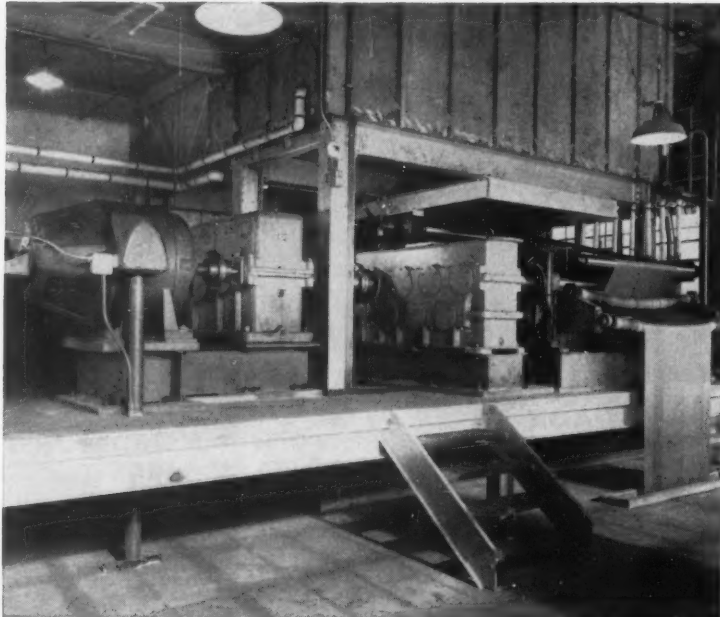
For ultra-precision, a new Grade AAA has been established with tolerances of plus or minus one-millionth inch per inch, or less.

Here is the first basic improvement in overall gage block standards since World War I, when .001" was considered a close tolerance for parts. Here is DoALL's answer to today's needs for gages qualified to check parts to tenths, half-tenths and less. You pay no premium for this needed improvement in accuracy, thanks to DoALL's advanced manufacturing techniques. Remember you get A Grade gage blocks at B Grade prices. Get the facts. Call your local DoALL Store or write:

**The DoALL Company**

254 N. Laurel Ave., Des Plaines, Illinois

# Lee Rubber and Tire Corp. increases tire strength... speeds production with **H & S** speed reducers!



To satisfy demand for larger, heavy-duty tires, the tire industry found that Nylon cord tension must be increased. Lee Rubber and Tire Corp. solved this problem with the help of H & S engineering. At their Conshohocken, Pa. plant two new drive units consisting of a 125 H.P. motor, an H & S LD-3600 speed reducer and a special H & S seven shaft roll drive were installed.

Now 1200 to 1920 strands of Nylon pass through the tensioning cycle at a speed of 180 fpm. As the fabric leaves the "hold back roll" run at a constant speed, it passes through a temperature of 400°F for proper heat treating. H & S powered "pull up rolls" can exert a tension from 0 to 20,000 lbs. (Older drives were limited to a tension of approximately 1500 lbs.)

**The result**—greatly increased tension capacity enables the Lee Rubber and Tire Corp. to "set" the Nylon cords limiting growth in tire use to 2 or 2½%. (Formerly cord growth amounted to as much as 14%). Improved tire quality and faster production were achieved.

If you have a power transmission problem, won't you let us help you? Our diversified lines assure our unbiased recommendation. Contact your H & S representative or write us today.

## THE HORSBURGH & SCOTT CO.

GEARS AND SPEED REDUCERS

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Cleveland 14, Ohio

Send note on Company Letterhead for complete H & S Catalog

Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.  
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

### BRONZE

American Brass Co., Waterbury 20, Conn.  
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio  
Bridgeport Brass Co., Bridgeport, Conn.  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Mueller Brass Co., Port Huron 35, Mich.

### BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

### BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

### BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Erie Foundry Co., Erie, Pa.  
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### BURS

See Files and Burs, Rotary

### BUSHINGS, Brass, Bronze, Carbide, Etc.

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.  
Kennametal, Inc., Latrobe, Pa.  
Shenango-Penn Mold Co., Dover, Ohio.

### BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.  
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.  
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

### BUSHINGS, Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Universal Engrg. Co., Frankenmuth, Mich.

### CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

### CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Starrett, The L. S. Co., Athol, Mass.

### CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Fellows Gear Shaper Co., Springfield, Vt.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Sundstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

**CAM MILLING AND GRINDING MACHINES**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.  
 Landis Tool Co., Waynesboro, Pa.  
 Rowbottom Machine Co., Waterbury, Conn.

**CAMS**

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.  
 Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.  
 Rowbottom Machine Co., Waterbury, Conn.

**CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Kennametal, Inc., Latrobe, Pa.  
 Metal Carbides Corp., Youngstown, Ohio.  
 Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**CASEHARDENING FURNACES**

See Furnaces, Heat-Treating

**CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.**

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.  
 Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
 Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.  
 Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.  
 Mueller Brass Co., Port Huron 35, Mich.  
 Shenango-Penn Mold Co., Dover, Ohio.

**CASTINGS, DIE**

American Brass Co., Waterbury 20, Conn.  
 Madison-Kipp Corp., Madison, Wisc.

**CASTINGS, Iron**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Chambersburg Engineering Co., Chambersburg, Pa.  
 Shenango-Penn Mold Co., Dover, Ohio.

**CASTINGS, Steel, Alloys, Etc.**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.  
 Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.  
 U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

**CEMENT, Disc Grinding Wheel**

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**CENTERING MACHINES**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Jones & Lamson Mch. Co., Springfield, Vt.  
 Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.  
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(Continued on page 294)

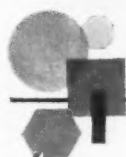


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**138 Sidney Street, Cambridge 39, Massachusetts**

**CENTERS, Lathe**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
 Cleveland Twist Drill Co., Cleveland, Ohio.  
 Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
 Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.  
 Kennametal, Inc., Latrobe, Pa.  
 Metal Carbides Corp., Youngstown, Ohio.  
 Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**CHAINS, Power Transmission and****Conveyor**

Boston Gear Works, 3200 Main St., North Quincy, Mass.  
 Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

**CHISELS AND CHISEL BLANKS**

Bethlehem Steel Co., Bethlehem, Pa.  
 Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

**CHUCKING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.  
 Bullard Co., Brewster St., Bridgeport 2, Conn.

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.  
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.  
 National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.  
 Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
 Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

**CHUCKS, Air Operated**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
 Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
 Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.  
 Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
 Tomkins-Johnson Co., Jackson, Mich.  
 Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**CHUCKS, Collet or Split**

See Collets

**CHUCKS, Diaphragm**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 Gleason Works, 1000 University Ave., Rochester, N. Y.  
 Van Norman Co., 2640 Main St., Springfield 7, Mass.

**CHUCKS, Drill**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.  
 Jacobs Mfg. Co., West Hartford, Conn.  
 Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
 Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
 Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

**CHUCKS, Full Floating**

Gisholt Mch. Co., Madison 10, Wis.  
 Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
 Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Gear**

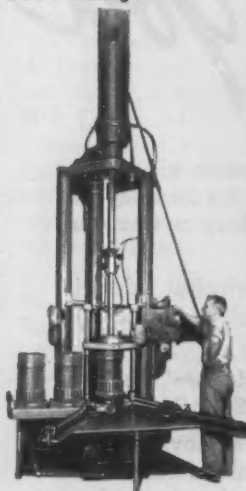
Gleason Works, 1000 University Ave., Rochester, N. Y.  
 Horton Chuck, Windsor Locks, Conn.  
 Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

**CHUCKS, Lathes, etc.**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
 Bullard Co., Brewster St., Bridgeport 2 Conn.  
 Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.  
 Gisholt Mch. Co., Madison 10, Wis.  
 Horton Chuck, Windsor Locks, Conn.  
 Jacobs Mfg. Co., West Hartford, Conn.  
 Jones & Lamson Mch. Co., Springfield, Vt.  
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.  
 Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.  
 Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

So you think we're just talking?  
**But**  
**FULMER CAN HONE IN 40 MINUTES**  
**JOBS FORMERLY GROUND**  
**IN 16 HOURS!**

The same unbelievable savings can be **PERFORMANCE-GUARANTEED** on internal bore honing.



The replacement of conventional bore finishing methods with Fulmer Precision-Honing usually brings time and cost savings that, at first glance, appear unbelievable! Production estimates by Fulmer engineers are based on long experience and calculated by a positive mathematical formula which is consistently proved accurate.

FULMER Precision-honing of internal bores is a stock-removing process in which abrasive stones are applied under controlled pressure to produce a round and straight bore to accuracy as close as .0001 (±) in. It removes as much as 1/16 in. from the diameter at rates up to 1½ cu. in. per minute. Chip curls as long as six inches demonstrate the stock-removing properties of the Fulmer honing process. Fulmer precision honing of internal bores assures amazing savings. Other finishing methods are new "old fashioned" — Why not get up to date? Write for bulletin on honing to: C. Allen Fulmer Co., Dept. M, 107 E. 4th St., Cincinnati 2, Ohio



**FULMER honing equipment**





## C

## Product Directory

**CHUCKS, Magnetic**

Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Hanchett Magna-Lock Corp., Big Rapids, Mich.  
Walker, O. S. Co., Inc., Worcester, Mass.

**CHUCKS, Power Operated**

Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Quick Change and Safety**

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Ring Wheel**

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

**CHUCKS, Tapping**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Jacobs Mfg. Co., West Hartford, Conn.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CIRCUIT-BREAKERS**

General Electric Co., Schenectady 5, N. Y.

**CLAMPS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Starrett, The L. S. Co., Athol, Mass.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**CLEANERS, Chemical, for Metal**

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.  
Oakite Products, Inc., 19 Rector St., New York, N. Y.

**CLUTCHES**

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.  
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**COLLARS, Safety**

Standard Pressed Steel Co., Jenkintown, Pa.

**COLLETS**

Axelsson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Tomkins-Johnson Co., Jackson, Mich.  
Universal Engrg. Co., Frankenmuth 2, Mich.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**COMPARATORS**

See Gages, Comparator

**COMPARATORS, Optical**

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Eastman Kodak Co., Rochester, N. Y.  
Jones & Lamson Mch. Co., Springfield, Vt.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**COMPOUNDS, Cleaning**

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
Oakite Products, Inc., 19 Rector St., New York.

**COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.**

Cities Service Oil Co., 70 Pine St., New York, N. Y.  
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).

(Continued on page 298)

**Magnaflux Inspection**

**ensures CIRCLE R QUALITY**

We specialize in the finest saws and other circular metal cutting tools. Quality is controlled and cost is lowered with scientific Magnaflux Inspection. This method reduces to minimum the occurrence of flaws in our product. For us, it identifies rejects before they reach the costly finishing stages. For you, it eliminates much of the usual down time due to defects. Refer to Catalog N for the complete line of Circle R cutting tools for automation and standard production.

**Precision cutting tools for automation and standard production**

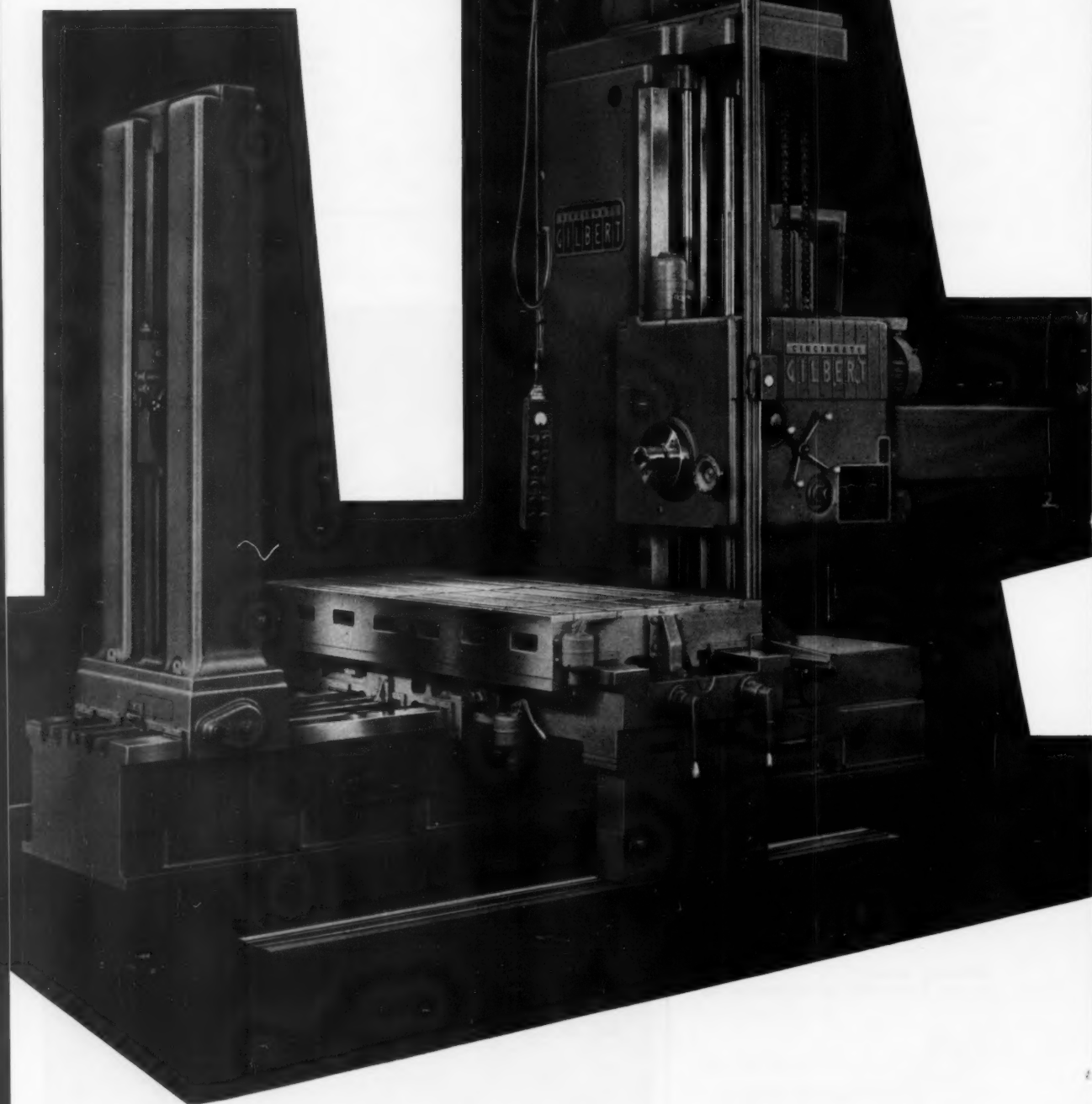
Consult CIRCLE R Specialists in —

Burbank	Hackensack	New York City	Pittsburgh
Chicago	Indianapolis	Philadelphia	Providence
Cleveland	Kansas City	Montreal	Rochester
Dayton	Milwaukee	Phoenix	St. Louis
Detroit			Westbury, L. I.

METAL SLITTING SAWS  
COPPER SLITTING SAWS  
SCREW SLITTING SAWS  
COMMUTATOR SLITTING SAWS  
JEWELERS' SLITTING SAWS  
CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCULOID STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS  
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

**CIRCULAR TOOL CO., INC.**  
PROVIDENCE 5, RHODE ISLAND

You can acquire a new 4" Table Type machine for as little as \$1.71 an hour, if you operate two 40-hour shifts, by using Gilbert's new financing plan: 6% simple interest (3% add on), up to 5 years to pay. (These prices are subject to change.) 3½" and 3¾" Table Type machines cost even less to own.



new 4" and 5"

Every modern feature that can reduce floor-to-floor time is built into these new Gilbert 4" and 5" boring mills.

For one example, your operator can pre-select speeds and feeds, and power automatic shifting takes over from there. For another, the pushbutton station makes his job easier and reduces his machine-handling time. This controls start, stop, and reverse for spindle; spindle electric clutch and brake; reverse for all feeds; forward, reverse power rapid traverse; spindle and milling feeds and rapid traverse; back gear clutch on spindle sleeve; milling feeds to head, table, and saddle (table type), or head and column (floor type); spindle feed electric clutch; power clamp, head to column (table type) or to head and base-to-runway (floor type); and automatic positioning, if ordered.

The built-in reversible motor (up to 20 hp) on the head puts maximum power to the tool; there are no long drive shafts. Speeds up to 1,500 rpm are standard.

*The Cincinnati Gilbert Machine Tool Co.  
3366 Beekman Street, Cincinnati 23, Ohio*

*those who buy*  
**GILBERT**  
*buy Gilbert again*



# boring mills



"Why was  
**ALLEN-BRADLEY**  
the preferred motor control  
at the Chicago Machine Tool Show?"



Because experience has established its  
**ACCURATE, RELIABLE, AND  
TROUBLE-FREE PERFORMANCE**

A survey of the electrical controls—wherever accessible—used with 849 machine tools exhibited at the recent Chicago Machine Tool Show, established the fact that Allen-Bradley motor starters, relays, timing relays, and disconnect switches led all other makes.

Allen-Bradley motor control has gained this position of leadership by its performance... its long life... consistency of action... trouble-free operation. The A-B trademark has come to be recognized as the sign of **QUALITY** in motor control.

Allen-Bradley Co., 1331 S. First St., Milwaukee 4, Wis.  
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.



**FIRST!**  
**in Starters—**  
41% of the starters  
were Allen-Bradley.



**FIRST!**  
**in Relays—**  
46.5% of the relays  
were Allen-Bradley.

**FIRST! in Disconnect Switches—**  
29.6% of the dis-  
connect switches  
were Allen-Bradley.



**FIRST!**  
**in Timing Relays—**  
51.7% of the timers  
were Allen-Bradley.



**ALLEN-BRADLEY**  
**MOTOR CONTROL**  
The PREFERRED Line



Oakite Products, Inc., 19 Rector St., New York, N. Y.  
Shell Oil Co., 50 W. 50th St., New York, N. Y.  
Sinclair Refining Co., 600 Fifth Ave., New York.  
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.  
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.  
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
Texas Co., 135 E. 42nd St., New York, N. Y.  
White & Bagley Co., Worcester, Mass.

#### COMPOUNDS, Resin and Molding

Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N.Y., N.Y.  
General Electric Co., Schenectady 5, N. Y.

#### COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Ingersoll-Rand Co., Phillipsburg, N. J.

#### CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

#### CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Blanchard Mch. Co., 64 State St., Cambridge, Mass.  
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.  
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.  
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.  
Erie Foundry Co., Erie, Pa.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
Fellows Gear Shaper Co., Springfield, Vt.  
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.  
Lees-Bradner Co., Cleveland, Ohio.  
Minster Machine Co., Minster, Ohio.  
Mummert-Dixon Co., Hanover, Pa.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.  
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

#### CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.  
Clark Controller Co., Cleveland, Ohio.  
General Electric Co., Schenectady 5, N. Y.

#### CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

#### COOLANT SEPARATORS

See Separators, Oil or Coolant

#### COOLANT SYSTEMS

Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.

#### COPPER

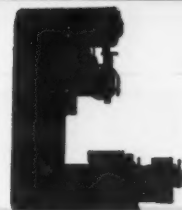
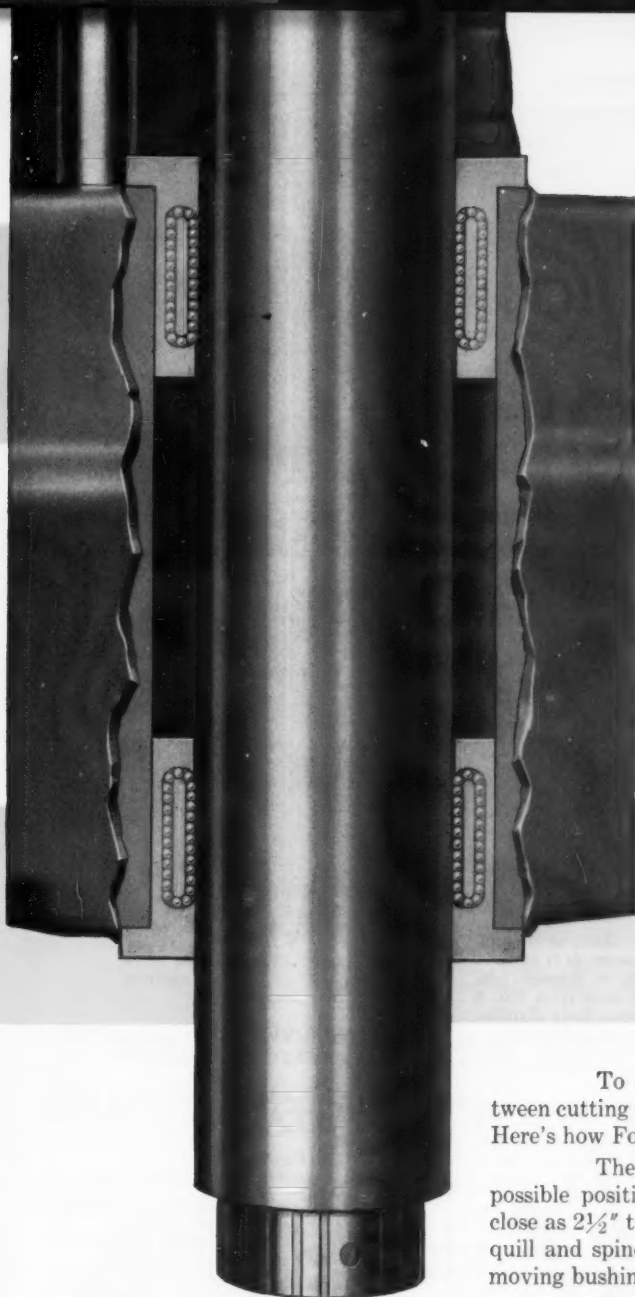
American Brass Co., 25 Broadway, New York, N. Y.  
Mueller Brass Co., Port Huron 35, Mich.  
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

#### COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(Continued on page 300)





## NEW QUILL BEARING DESIGN helps achieve extreme precision in Fosmatic Jig Borer

To bore with precision as close as  $\pm .0001"$ , distance between cutting tool and lower quill bearing must be held to a minimum. Here's how Fosdick minimizes this crucial distance.

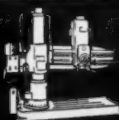
The lower quill bearing is *permanently* located at the lowest possible position in the head, permits boring with spindle nose as close as  $2\frac{1}{2}"$  to the bearing. Bearing does not ride up and down with quill and spindle as in conventional designs where balls are held in moving bushings.

The permanent location of quill bearings is made possible by unique Fosdick design—vertical ball races with preloaded precision balls circulating continuously. This design also permits spindle and quill to be shorter; thus stronger and more rigid. Both are perfect cylinders with no cuts on the outside.

Engineering advancements like this make the Fosmatic Jig Borer the most rigid and precise boring machine you can buy. Write today for the new catalog.

*Eight models available from the low-cost Model 30 with 36" x 18" table, to the virtually automatic model 54P with 54" x 22" table. Other important features: Automatic Positioning, choice of two precision measuring systems, milling feed, rapid traverse to quill, power clamping of table and saddle, coolant system and reversing motor control for tapping.*

**NEED JIG BORING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!**



Fosmatic  
Radial Drills



Jig  
Borers



Sensitive and  
Upright Drills



Sensitive  
Radial Drills



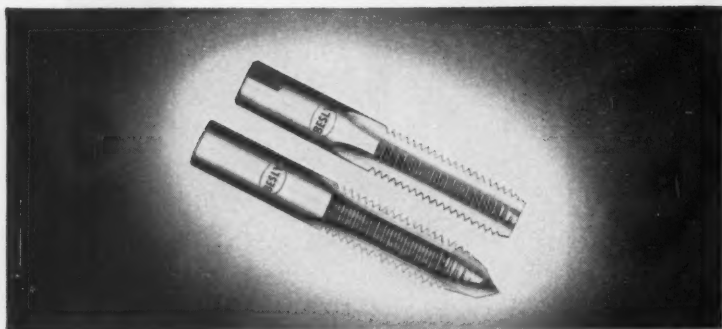
Jig  
Grinders



Automatic Positioning  
Jig Borers

# FOSDICK

**THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO**



## New Besly Stub Tap for Screw Machines

*Saves Set-up Time, Fits Standard Bushings, Has Stronger Shank  
Available at No Extra Cost from BESLY*

A new, shorter length tap that eliminates the need to make alterations before using it in screw machines has just been developed by Besly in cooperation with the National Screw Machine Products Association.

### SHORTER SHANK, SHORTER THREADED PORTION

The shank (and threaded portions in larger sizes) of the new Stub Tap have been shortened to enable it to fit into the space between the spindle nose and tool holder of screw machines. In the past, it has been necessary for users to cut off part of the shank and even part of the threaded portion of standard hand taps to fit them into screw machines... or order higher priced "specials."

### SIMPLIFIES BUSHING INVENTORY

The shank of a Stub Tap is the same size as its nominal O.D. This permits standard sized bushings to be used and reduces bushing inventory problems. The full dia-

meter shank provides greater strength than standard hand taps which have shanks usually turned down in the larger sizes.

### FACTORY-PERFECT ACCURACY

The shank of the Stub Tap is made concentric with the threaded portion, assuring accurate alignment in the tool holder. Since it is not necessary to cut off the forward threaded portion of a Stub Tap, chamfer is maintained factory-perfect. Squares, except for two small driver flats at the end of the Stub Tap, are eliminated. This permits better holding power, better alignment and longer accuracy.

### AVAILABLE IN SIZES THROUGH 1-IN.

The new Stub Tap is available at no extra cost from Besly distributors. It is made in fractional sizes from 1/4-in. through 1-in. and in machine screw sizes from No. 0 through No. 14. See your Besly distributor or write for the sizes you need.

### BESLY HAS THE COMPLETE LINE



TAPS

DRILLS

REAMERS and END MILLS



High Speed TOOL BITS



CARBIDE TIPPED TOOLS



GAGES



**BESLY-WELLES  
CORPORATION**

Est. as C. H. Besly & Co. in 1875

112 Dearborn Avenue, South Beloit, Illinois

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 52nd St., New York.  
Kennametal, Inc., Latrobe, Pa.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Starrett, The L. S. Co., Athol, Mass.  
Threadwell Tap & Die Co., Greenfield, Mass.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

### COUNTERSINKS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Dr. All Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 52nd St., New York.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.  
Starrett, The L. S. Co., Athol, Mass.

### COUNTING DEVICES

Starrett, The L. S. Co., Athol, Mass.

### COUPLINGS, Flexible

Boston Gear Works 3200 Main St., North Quincy, Mass.  
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

### COUPLINGS, Shaft

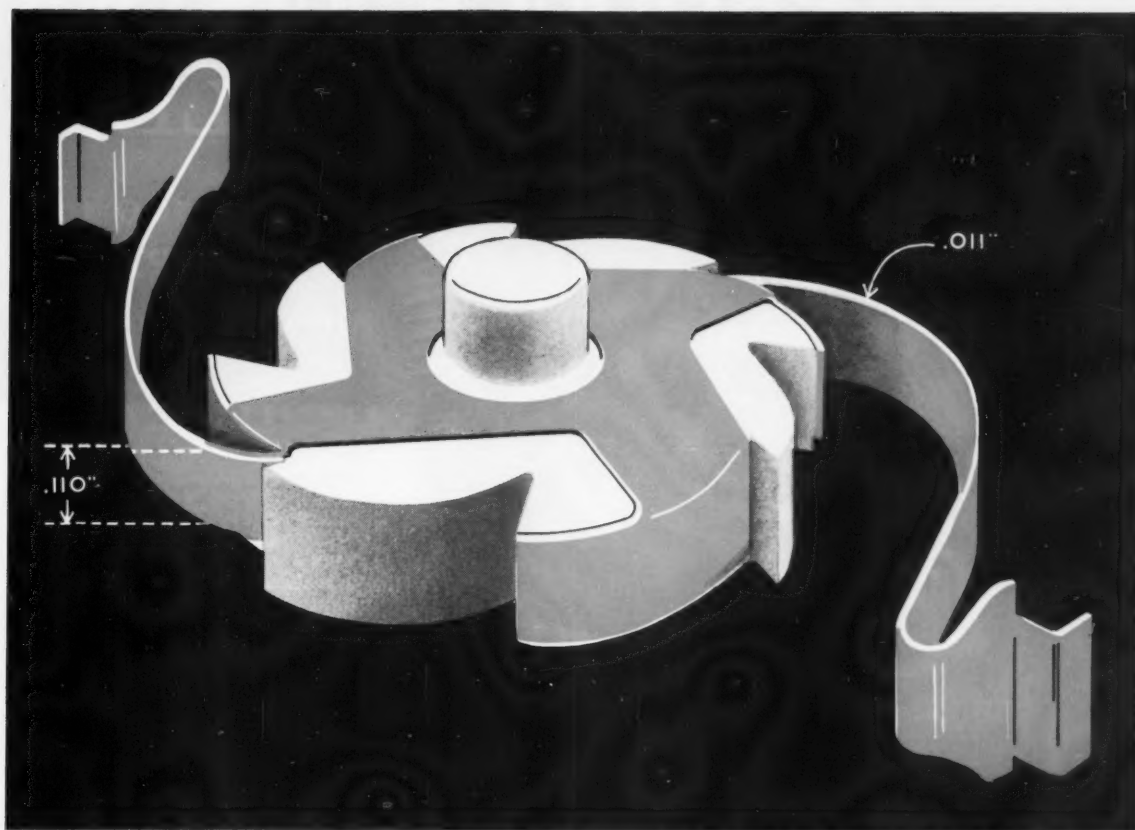
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Cone-Drive Gear Div., Michigan Tool Co. 7171 E. McNichols Rd., Detroit 12, Mich.  
Standard Pressed Steel Co., Jenkintown, Pa.

### CRANES, Electric Traveling

Cleveland Crane & Engrg Co., Wickliffe, Ohio.

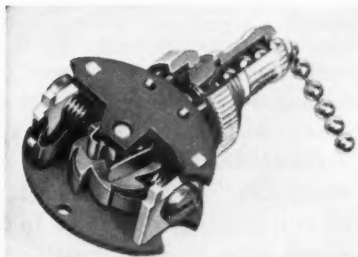
### CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.  
(Continued on page 304)



**Enlargement** showing the contact springs at the "heart" of one model of the Levolver® switch mechanism. Levolver switches are used in industrial and commercial lighting, in heavy-duty industrial sockets, in appliances, fixtures, etc.

## The Anaconda alloy tailored for this punishing service actually costs less



**Cutaway** of Levolver Switch No. 41 shown approximately actual size.

**THE PROBLEM:** The McGill Manufacturing Company, Inc., Valparaiso, Indiana, was interested in a desirable substitute for a premium copper alloy used in contact springs for their widely known Levolver switch mechanisms. Unexcelled quality had to be maintained with a new alloy that would help hold prices against rising costs. As these switches are designed for long service and heavy-duty

industrial service, the spring material has to be tough and durable.

**THE SOLUTION:** In 1952, McGill discussed the problem of an alternate spring material with a metallurgical engineer from The American Brass Company. After an analysis of the requirements, a special Anaconda alloy was offered—Ambronze-422, rolled to spring temper.

Samples were prepared and tested by McGill and Underwriters' Laboratories. The material performed satisfactorily in standard tests—current carrying capacity, 6 amps at 125 volts d.c.—readily exceeded the requirements of 75,000 cycles, or 150,000 individual operations.

In production, the new Anaconda alloy also performed satisfactorily. It was necessary to make only one minor die-

forming change. McGill received a desirable saving in material costs—product quality remained high—and the material was available as needed to maintain production.

**FREE TECHNICAL SERVICE:** This is another example of the Anaconda technical service available to metal users. Sometimes a new alloy is required—other times a variation of a standard alloy will do the job. The Technical Department of The American Brass Company, through its day-to-day work with a wide variety of metal problems, offers a tremendous breadth of experience, which is at your disposal. See your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

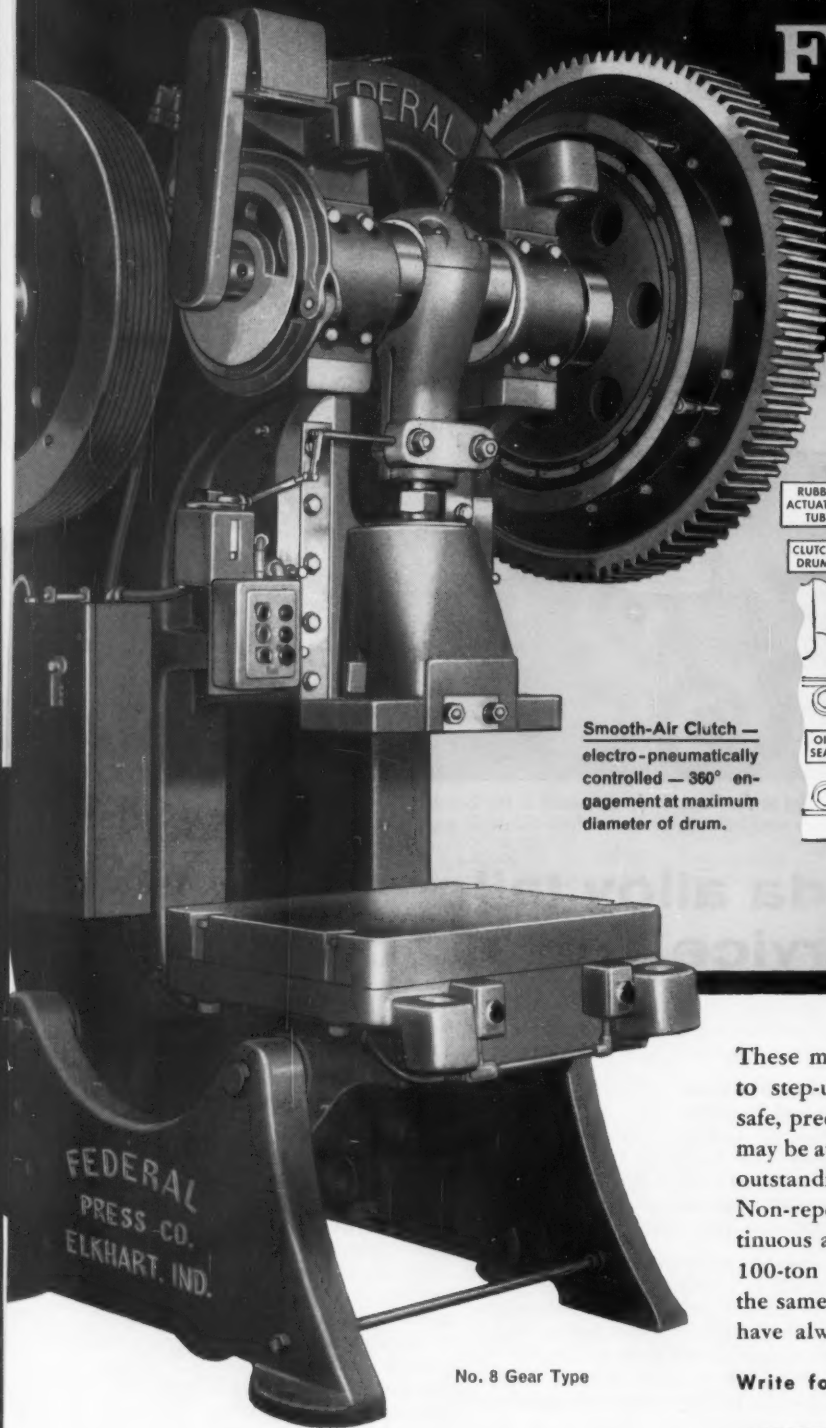
**ANACONDA<sup>®</sup>** **COPPER AND COPPER ALLOYS**

For more information fill in page number on Inquiry Card, on page 261

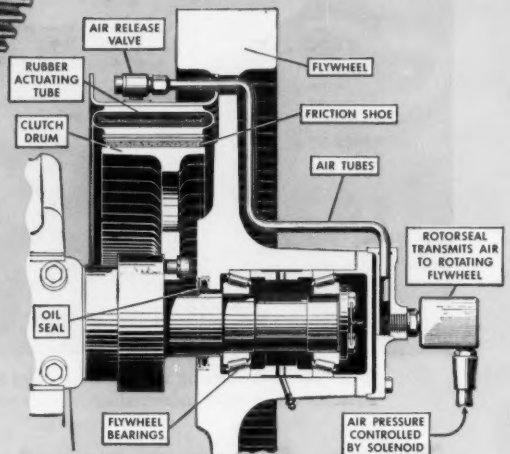
MACHINERY, July, 1956—301

Now you can **PRODUCE FASTER  
FOR LESS**

with this 100-ton  
**FEDERAL**  
air-clutch press



**Smooth-Air Clutch** —  
electro-pneumatically  
controlled — 360° en-  
gagement at maximum  
diameter of drum.



These modern Federal Presses have what it takes to step-up production and cut unit costs! Their safe, precision, fatigue-free operation *at high speeds* may be attributed to the fast-acting clutch plus other outstanding features. Dual-solenoid safety valve. Non-repeat mechanism. "Inching" control. Continuous as well as single-cycle operation. In 6.6 to 100-ton capacities, these rugged presses embody the same superior materials and workmanship that have always distinguished Federal's construction.

Write for new catalog showing complete line.

**FEDERAL PRESS COMPANY**

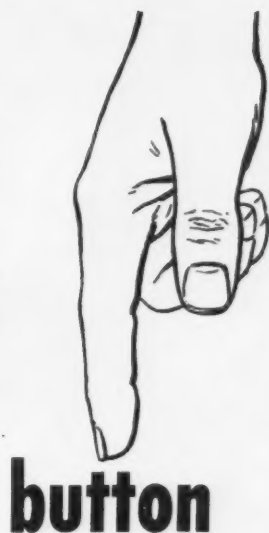
601 Division Street, Elkhart, Indiana

**FEDERAL** *Open back  
Inclinable* **PRESSES**

31 Years of Quality Construction



# ACCURATE GEARS at the touch of a



Highest accuracy over broadest work range at faster cutting speeds — that's the kind of overall performance available from a Farrel-Sykes "Twin-Head" gear generator. And because the machine is equipped with complete electrohydro control, you can take fullest advantage of its many benefits. For all operations, the machine responds instantly to the touch of push buttons on a conveniently located panel.

Built with high initial precision, the "Twin-Head" gear generator provides means of compensating for wear to sustain accuracy through many thousands of operating hours. And the accuracy inherent in the machine assures accurate tooth spacing, profile and helix angle in the gears it produces.

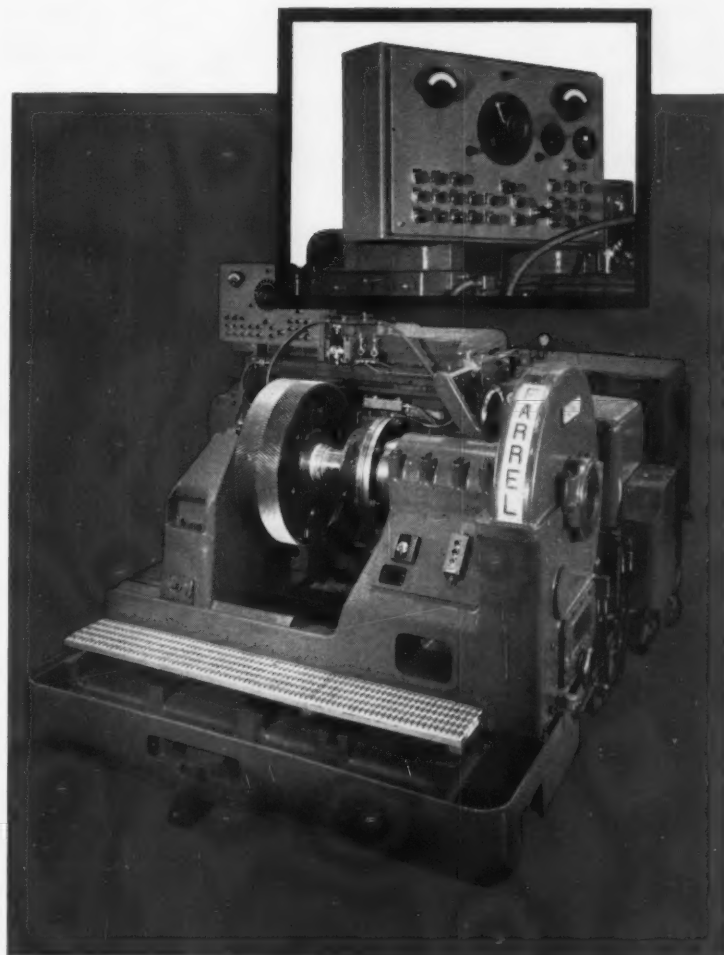
The "Twin-Head" machine makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears with external or internal teeth, two members of a cluster gear at the same time, and other gears that operate on parallel axes.

*We shall be glad to give you full details.*

**FARREL-BIRMINGHAM COMPANY, INC.**  
ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston



## *Farrel-Birmingham®*

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—303

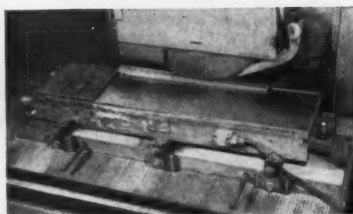
FB-1084



Magna-Lock chuck holds six tapered gibs during roughing operation.

# PRODUCTION UP 25%

*with*  
**ELECTRO-MAGNETIC**  
**Magna-Lock**  
**CHUCK**

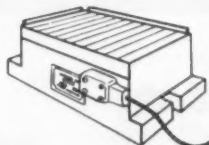


Magna-Lock chuck holds gib during finish grinding.

At Gisholt Machine Company, roughing and finishing operations on 24" tapered gibs are done on a surface grinder. The gibs are held by a Magna-Lock chuck and are rough ground six at a time and finish ground individually. Spindle and table speeds for both operations is 1200 r.p.m. and 100 f.p.m. respectively. Stock removed is .020" to .025". There is no scrap, no rejects. Fixture set-up time is eliminated. Since using the Magna-Lock chuck, production has increased 25%.

This is one of the many examples of how the *extra bolding power* of Magna-Lock all-steel, all-welded electric magnetic chucks steps up production, reduces costs.

*Solve your holding problems with Magna-Lock magnetic chucks—a complete line to meet your requirements. WRITE TODAY, Dept. M-76.*



**Hanchett MAGNA-LOCK**  
**CORPORATION**  
BIG RAPIDS, MICHIGAN, U. S. A.

*designers and makers of a complete line of magnetic chucks and devices.*

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).  
National Twist Drill & Tl. Co., Rochester, Mich.  
Waltham Mch. Works, Newton St., Waltham, Mass.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

## CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
du Mont Corp., Greenfield, Mass.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Threadwell Tap & Die Co., Greenfield, Mass.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

## CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.  
Barber-Colman Co., Rock St., Rockford, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Kennametal, Inc., Latrobe, Pa.  
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.  
National Twist Drill & Tl. Co., Rochester, Mich.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scully-Jones & Co., 1903 Rockwell St., Chicago, Mich.  
Tamkins-Johnson Co., Jackson, Mich.  
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See Files & Burrs Rotary

## CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

## CUTTING AND GRINDING FLUIDS

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Cincool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.  
Cities Service Oil Co., 70 Pine St., New York, N. Y.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
Shell Oil Co., 50 W. 50th St., New York, N. Y.  
Sinclair Refining Co., 600 Fifth Ave., New York.  
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.  
Stuart D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.  
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
Texas Co., 135 E. 42nd St., New York, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.  
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).  
Consolidated Mch. Tool Co., Rochester, N. Y.  
(Continued on page 306)



**Hamilton  
announces...**

**exclusive double lube protection  
for new top drive full eccentric presses**

New from Hamilton . . . two major mechanical press developments in one . . . a complete new line of welded steel, top drive, full eccentric presses from 300 to 4000 tons . . . an exclusive new double lube system protects each press for extra-long, trouble-free service and for smoother, precision performance.

Hamilton double lube is a combination of a carefully engineered pressure oil lubrication system PLUS a complete set of troughs and gravity flow channels to provide gravity lubrication. All bearings are positively lubricated even if pressure and flow switches should fail. Double lube is double insurance against lubrication failure—a major cause of costly downtime.

In addition, this line features Hamilton's new air

clutch, which combines all the advantages of two types . . . low inertia and mechanical interlocking.

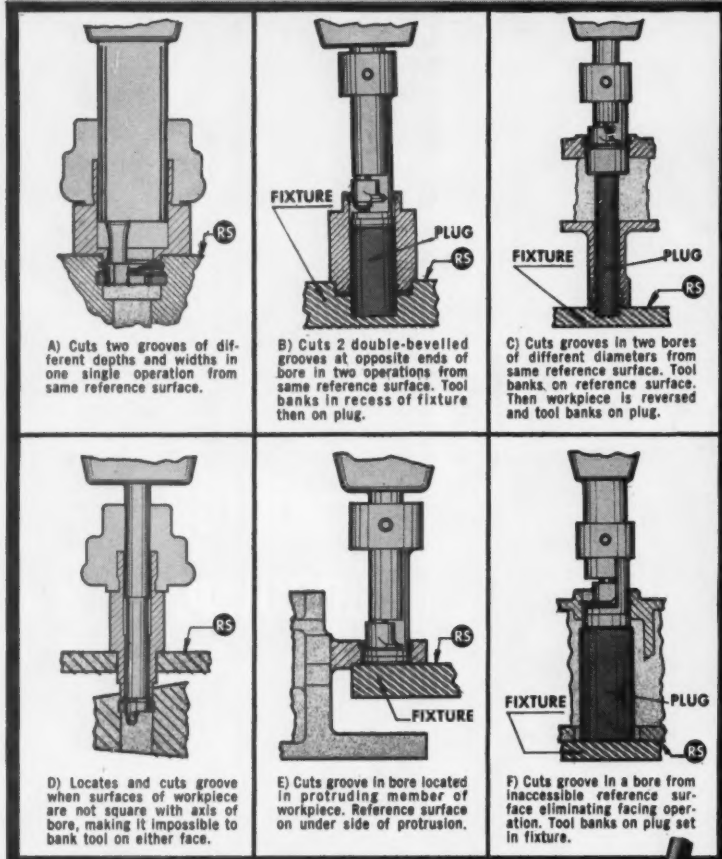
Hamilton—pioneer of the giant automotive stamping presses—meets today's demand for higher quality, faster production, less downtime. Put this know-how to work for you! Send for the full story. Write Dept. 4419, Hamilton Division, BLH Corporation, Hamilton, Ohio.



**HAMILTON DIVISION  
BALDWIN-LIMA-HAMILTON**

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## Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



**Amazingly versatile!** Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

**Wide Cutting Range!** The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

**Send Your Problems to Waldes!** Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool



**WALDES  
TRUARC®  
GROOVING TOOL**

Made by the Manufacturers of Waldes Truarc Retaining Rings  
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Waldes Truarc Grooving Tool Manufactured  
Under U. S. Pat. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.  
Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Landis Machine Co., Waynesboro, Pa., (Pipe).  
Modern Machine Tool Co., 601 S. Water St.,  
Jackson, Mich. (Lathe Type for Tubing).

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#### Abrasive Wheel

Campbell Machine Div., American Chain &  
Cable, Bridgeport, Conn.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
Hamilton Div., The Lodge & Shipley Co.,  
Hamilton 1, Ohio.

### CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular

### CUTTING-OFF MACHINES,

#### Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
dale Ave., Chicago, Ill.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Johnson Mfg. Co., Albion, Mich.

### CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Armstrong Bros. Tool Co., 5200 W. Armstrong  
Ave., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland 14, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Haynes Stellite Div., Union Carbide & Carbon  
Corp., 30 E. 42nd St., New York N. Y.  
Kennametal, Inc., Latrobe, Pa.  
Pratt & Whitney Co., Inc., West Hartford,  
Conn.  
Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

### CUTTING-OFF WHEELS, Abrasive

Norton Co., 1 New Bond St., Worcester, Mass.  
Simonds Abrasive Co., Tacony & Farley Sts.,  
Philadelphia 37, Pa.

### CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo  
10, Ohio.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton  
Div., Hamilton, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit  
32, Mich.  
Ingersoll Milling Mch. Co., 2424 Douglas St.,  
Rockford, Ill.  
Michigan Drill Head Co., Detroit 34, Mich.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.

### CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.  
Rivett Lathe & Grinder, Inc., Brighton, Boston  
35, Mass.  
Tomkins-Johnson Co., Jackson, Mich.

### CYLINDERS, Hydraulic

Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Logansport Machine Co. Inc., 810 Center Ave.,  
Logansport, Ind.  
National Forge & Ordnance Co., Irvine, Warren  
County, Pa.  
Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.  
Rivett Lathe & Grinder, Inc., Brighton, Boston  
35, Mass.  
Rockford Machine Tool Co., 2500 Kiswaukee  
St., Rockford, Ill.  
Shenango-Penn Mold Co., Dover, Ohio.  
Tomkins-Johnson Co., Jackson, Mich.

### CYLINDERS, Pneumatic

Shenango-Penn Mold Co., Dover, Ohio.

### DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester,  
N. Y.  
Mott & Merryweather Mchry. Co., Penton  
Bldg., Cleveland, Ohio.  
Ryerson Jas. T. & Son, Inc., 2558 W. 16th St.,  
Chicago 18, Ill.

(Continued on page 308)



# NOW...

## PUSH BUTTON RADIAL DRILL OPERATION

with the *All-New Morris*

### *Hydra-Power* RADIAL DRILLS

Push buttons replace conventional levers and controls to make operation of these new 13" and 15" MORRIS Hydra-Power Radial Drills the easiest and fastest ever offered!

Pushing a button raises or lowers the arm; traverses the head left or right; clamps or unclamps the arm, head or column . . . even shifts the gears in these rugged new radials!

- Completely push button controlled
- Hydraulically actuated operations
- All buttons in single panel
- Completely integrated electro-hydraulic control system
- Pre-selection of spindle speeds and feeds
- Designed for rigidity and accuracy
- Full safety features
- Hydraulic gear shifting

#### Other important Morris Hydra-Power features:

- Automatic tool ejector
- Built-in electric light
- Adjustable spindle counterbalance
- 36 Spindle speeds; 4 ranges
- 18 Feeds, including 8, 11½, 14, 18 and 27 thread leads

Write for complete detailed information and prices!

The Morris Machine Tool Co.  
946 Harriet St., Cincinnati 13, Ohio



*Morris*



## D

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**DEMAGNETIZERS**

Blanchard Mch. Co., 64 State St., Cambridge, Mass.  
 Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.  
 Walker, O. S. Inc., Worcester, Mass.

**DESIGNERS, Machine and Tool**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**DIE-CASTING**

See Castings, Die

**DIE-CASTING MACHINES**

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
 Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

**DIE CUSHIONS**

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.  
 Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St. Chicago, Ill.  
 Federal Machine & Welder Co., Overland Ave., Warren, Ohio.

Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

**DIE INSERTS, Carbide**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Kennametal Inc., Latrobe, Pa.  
 Metal Carbides Corp., Youngstown, Ohio.

**DIEMAKERS' SUPPLIES**

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.  
 Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
 Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.  
 U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**DIEMAKING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.  
 Kearney & Trecker Corp., Milwaukee, Wis.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.

**DIE SETS, Standard**

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.  
 Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.  
 U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.  
 Wales-Strippet Corp., North Tonawanda, N. Y.

**DIE-SINKING MACHINES**

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio  
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
 Cincinnati Milling Mch. Co., Cincinnati, Ohio.  
 Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.

**DIE-SINKING PRESSES**

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.  
 Kearney & Trecker Corp., Milwaukee, Wis.  
 Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

**DIE STOCKS**

See Stocks, Die

**DIES, Lettering and Embossing**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

**DIES, Sheet Metal, Etc.**

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio  
 Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Chambersburg Engrg. Co., Chambersburg, Pa.  
 Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.  
 Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.  
 Ferracute Mch. Co., Bridgeton, N. J.  
 Metal Carbides Corp., Youngstown, Ohio.  
 Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.  
 Wales-Strippet Corp., North Tonawanda, N. Y.  
 Waltham Mch. Wks., Newton St., Waltham, Mass.

**DIES, Threading**

Eastern Mch. Screw Corp., New Haven, Conn.  
 Geometric Tool Co., Westville Station, New Haven 15, Conn.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
 National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Read Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Threadwell Tap & Die Co., Greenfield, Mass.

**DIES, Threading, Opening**

Eastern Mch. Screw Corp., New Haven, Conn.  
 Geometric Tool Co., Westville Station, New Haven 15, Conn.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.  
 Landis Mch. Co., Waynesboro, Pa.  
 National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DIES, Thread Rolling**

Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Read Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DISCS, Abrasives**

Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Norton Co., 1 New Bond St., Worcester, Mass.  
 (Continued on page 310)



**Designed to do  
a better job**

**Ruthman  
Gusher  
Coolant Pumps**

The simple designs and sturdy construction of Ruthman Gusher Pumps assure you long trouble-free life and efficient operation. There are fewer parts to wear, pre-lubricated heavy-duty ball bearings require no further lubrication — electronically balanced rotating assembly cuts vibration to minimum. So be sure to specify the pumps that are designed to do a better job . . . "Gusher" Pumps.



Illustrated is a model  
821-2 Microflat Machine  
equipped with a "Gusher"  
Coolant Pump—  
Photo courtesy of  
Micromatic Hone Corp.

**THE RUTHMAN MACHINERY CO.**  
1807 Reading Rd.  
Cincinnati, Ohio



# KENNAMETAL K7H

**has a definite place in your operations**

- for high-velocity machining
- for cutting heat-treated steels
- for cutting high tensile steels

Kennametal\* Grade K7H is being selected by shop after shop for high-velocity cutting operations . . . chiefly because of these desirable cutting edge characteristics: High hardness (93.5 Rockwell A) combined with phenomenal strength (three times that of nonmetals); exceptional wear resistance and maximum resistance to cratering; excellent retention of strength even at high temperatures; and top resistance to shock.

## HERE ARE EXAMPLES OF K7H PERFORMANCE

**Doubles production:** Cutting  $1\frac{1}{2}$ " wide stators of welded laminations of 2% silicon steel, K7H has out-performed all other cutting edges by better than two to one, with 147 pieces averaged per index for K7H against only 65 pieces per index with the best competitive carbides. *Conditions:* 900 sfm, .0083" feed, and .015" depth of cut. *Results:* Higher total production at end of day, with less machine down time, less scrap, better quality by holding tolerances, and lower tooling cost per stator (\$0.00109).

**Outperforms ceramics by more than 30 to one in test boring SAE 1020 steel, flash hard-**

\* Registered Trademark



INDUSTRY AND  
**KENNAMETAL**  
... *Partners in Progress*



For more information fill in page number on Inquiry Card, on page 261



Use Kendex Tooling with turn-over inserts (available in 17 styles and over 200 tools) . . . for lowest cost per cutting edge.

ened, length of bore  $1\frac{1}{4}$ ", depth .025" at 900 sfm. Grade K7H cut 67 pieces while ceramics only cut two (ceramics chipped). *Result:* K7H ordered for the operation.

K7H cuts 252 pieces as compared to 30 . . . the best record for a competitive carbide in facing cut to dead center of SAE 1018 steel 5" O.D. gear blank, at 1000 sfm (at outer edge) and .008" depth of cut. *Result:* Standardized on K7H.

**Performance 3 times greater than with competitive carbide cutting cast steel stator housing with six interruptions at 700 sfm, .014" feed, and  $\frac{1}{8}$ " depth of cut. *Result:* K7H was selected for the job.**

Why not discuss your machining problems with a Kennametal tool engineer. He will help you take full advantage of this remarkable cutting grade. Call him or write KENNAMETAL INC., Latrobe, Pa.

B-5987

MACHINERY, July, 1956—309

# TOWNSEND

OF HARTFORD

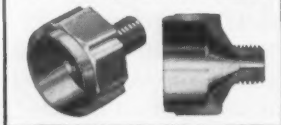
## QUALI-MATIC MACHINES

**ONE  
TOWNSEND  
AUTOMATIC**  
effects a 3-way  
**Saving**



**Performs 4 operations  
automatically**

The Townsend Special Drilling Machine mass produces oilmeter and ammeter switch housings at the rate of 1200 per hour; four separate operations by one machine to close tolerances (plus or minus .001). The four stage operation automatically **TURNS** (maintaining an accurate shoulder), **FACES-DEBURRS-DRILLS**.



### SAVES manpower costs!

One man operates 6 or more Townsend Qualimatics. He fills the hopper with switch housing blanks and they come out finished . . . automatically.

### SAVES on machinery costs!

The Townsend Qualimatic costs 1/3rd the cost of expensive multi-station machines, gives the advantages of repetitive, high-speed, accurate production with a minimum capital investment.

### SAVES through mass production!

With Townsend Qualimatics, it is possible to pace machine capacity with production and design demand. Townsend Qualimatics mean expandable production.

**The H. P. TOWNSEND  
MANUFACTURING CO.**  
ELMWOOD, CONNECTICUT

Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.  
Thor Power Tool Co., Aurora, Illinois  
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

### DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

### DIVIDING HEADS

See Indexing and Spacing Equipment

### DOLLIES

Mighty Mover Co., 1482 S. Milwaukee St., Denver 10, Colo.

### DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.  
Darily Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.  
Metal Carbides Corp., Youngstown, Ohio.  
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.  
Norton Co., 1 New Bond St., Worcester, Mass.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

### DRIFTS, DRILL

Armstrong, Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

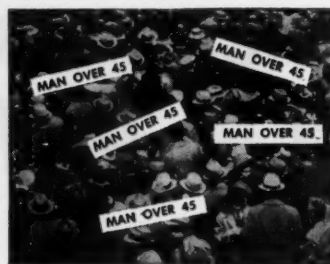
### DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Buffalo Forge Co., Broadway, Buffalo, N. Y.  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.  
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.  
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6302 Westfield Blvd., Indianapolis 5, Ind.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.  
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.  
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

### DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.  
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.

(Continued on page 312)



### But why MEN over 45?

Our doctors still don't know *why*, but if you are a man over 45 you are six times as likely to develop lung cancer as a man of your age twenty years ago. They *do* know, however, that their chances of saving your life could be about *ten times* greater if they could only detect cancer long before you yourself notice any symptom. (Only 1 in every 20 lung cancers is being cured today, largely because most cases progress too far before detected.)

That's why we urge that you make a habit of having your chest X-rayed every six months, no matter how well you may *feel*. The alarming increase of lung cancer in men over 45 more than justifies such precautions. Far too many men die *needlessly*!

Our new film "The Warning Shadow" will tell you what every man should know about lung cancer. To find where and when you can see this film, and to get life-saving facts about other forms of cancer, phone the American Cancer Society office nearest you or simply write to "Cancer"—in care of your local Post Office.

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Cancer  
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MACHINERY, July, 1956—311

**DRILL SOCKETS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Cleveland Twist Drill Co., Cleveland, Ohio.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 National Twist Drill & Tool Co., Rochester, Mich.  
 Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILL STANDS**

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 National Twist Drill & Tool Co., Rochester, Mich.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLING MACHINES, Automatic**

Avey Drilling Mach., Co., 26 Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Bodine Corp., Mt. Grove St., Bridgeport, Conn.  
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

Kingsbury Mch. Tool Corp., Keene, N. H.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Townsend, H. P., Mfg. Co., Elmwood, Conn.  
 Wales-Stripper Corp., North Tonawanda, N. Y.  
 Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**DRILLING MACHINES, Bench**

Atlas Press Co., Kalamazoo, Mich.  
 Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.  
 Buffalo Forge Co., 490 Broadway, Buffalo.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Edlund Machinery Co., Cortland, N. Y.  
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
 Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**DRILLING MACHINES, Boiler**

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.  
 Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

**DRILLING MACHINES, Deep Hole**

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Wales-Stripper Corp., North Tonawanda, N. Y.

**DRILLING MACHINES, Gang**

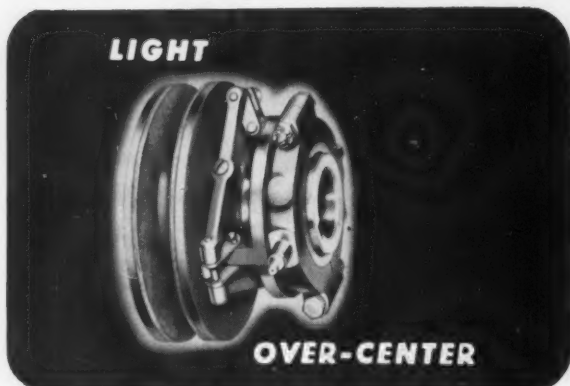
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Edlund Machinery Co., Cortland, N. Y.  
 Foote-Burt Co., 1300 St. Clair Ave., Cleveland.  
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Moline Tool Co., 102 20th St., Moline, Ill.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

**DRILLING MACHINES, Horiz.**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.  
 Edlund Machinery Co., Cortland, N. Y.  
 Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
 Kingsbury Mch. Tool Corp., Keene, N. H.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

(Continued on page 314)

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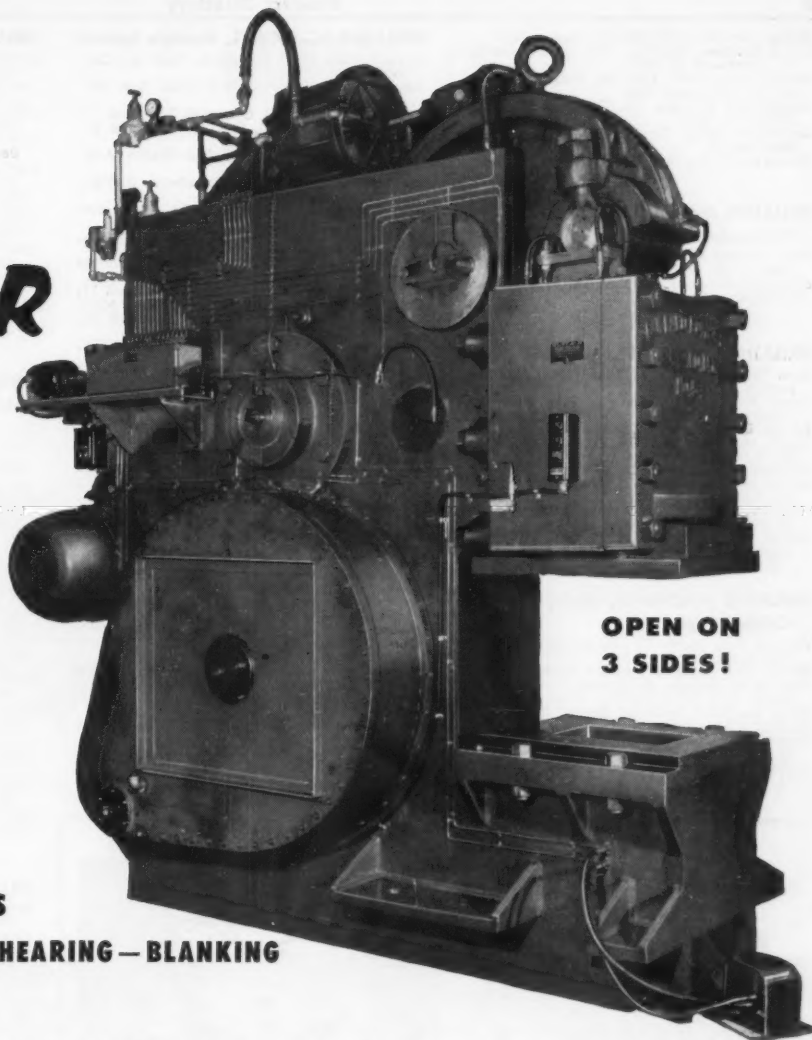
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MACHINERY, July, 1956—313

**D**

**Product Directory**

Moline Tool Co., 102 20th St., Moline, Ill.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
 Townsend, H. P., Mfg. Co., Elmwood, Conn.

**DRILLING MACHINES, Horizontal Portable**

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.  
 Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

**DRILLING MACHINES, Inverted**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

**DRILLING MACHINES, Multiple Center Column Type**

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

**DRILLING MACHINES, Multiple Spindle**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
 Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17, Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
 Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Edlund Machinery Co., Cortland, N. Y.  
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
 Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.  
 Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
 Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Kingsbury Mch. Tool Corp., Keene, N. H.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.  
 Moline Tool Co., 102 20th St., Moline, Ill.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Townsend, H. P., Mfg. Co., Elmwood, Conn.  
 Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**DRILLING MACHINES, Radial**

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.  
 Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.  
 Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.  
 Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.  
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
 Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

**DRILLING MACHINES, Rail**

See Drilling Machines, Gang

**DRILLING MACHINES, Sensitive**

Atlas Press Co., Kalamazoo, Mich.  
 Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Edlund Machinery Co., Cortland, N. Y.  
 Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.  
 Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Townsend, H. P., Mfg. Co., Elmwood, Conn.  
 Wales-Strippert Corp., North Tonawanda, N. Y.

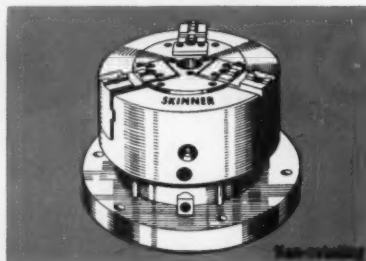
**DRILLING MACHINES, Upright**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Atlas Press Co., Kalamazoo, Mich.  
 Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.  
 Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.  
 Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
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 Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.  
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.  
 Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
 Moline Tool Co., 102 20th St., Moline, Ill.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Rehnborg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.  
 Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Wales-Strippert Corp., North Tonawanda, N. Y.

**DRILLING MACHINES, Wall, Radial**

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 (Continued on page 316)

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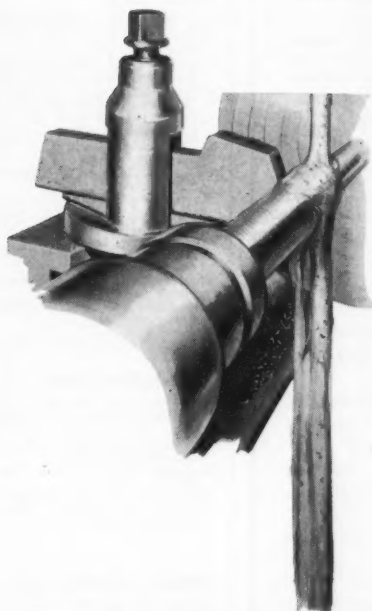


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Tank for purified oil

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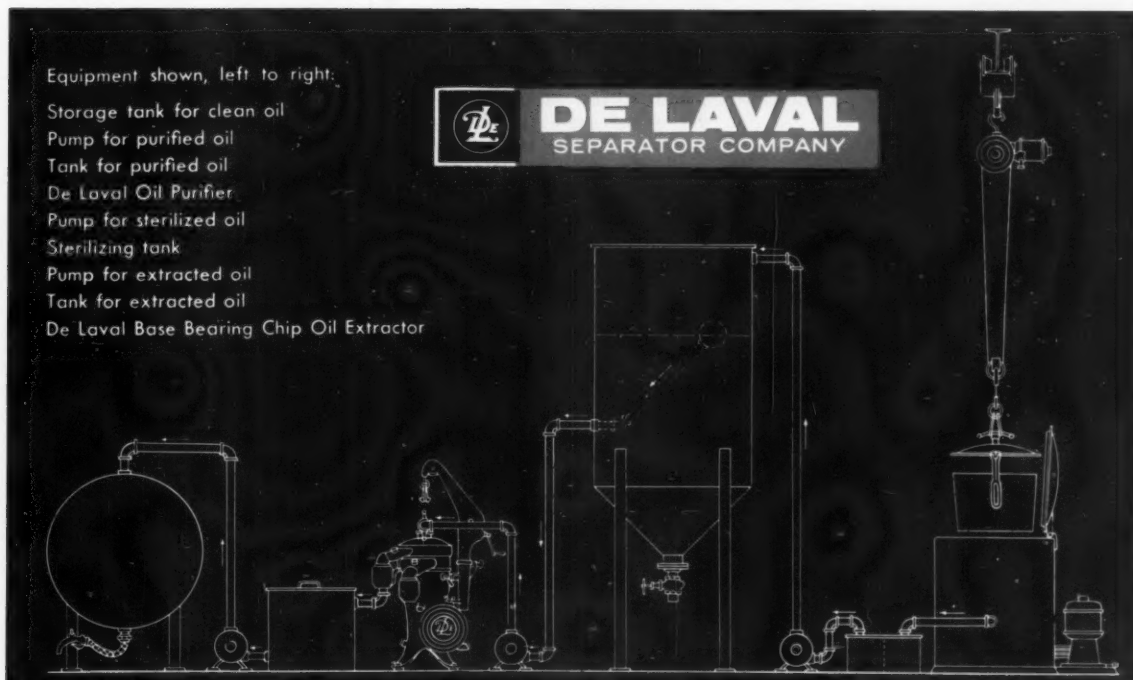
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Tank for extracted oil

De Laval Base Bearing Chip Oil Extractor



**DE LAVAL**  
SEPARATOR COMPANY



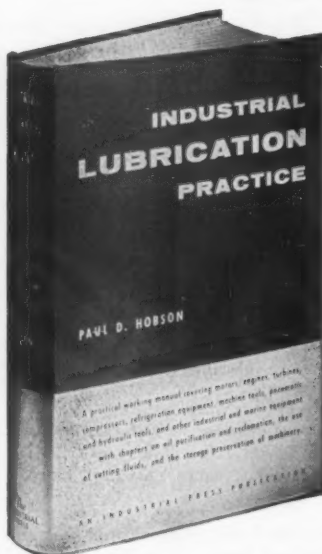
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For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—315

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILL, Core

Ace Drill Corp., Adrian, Michigan.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Deep Hole

Ace Drill Corp., Adrian, Michigan.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
National Twist Drill & Tool Co., Rochester, Mich.  
Star Cutter Co., Farmington, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.  
Thor Power Tool Co., Aurora, Illinois.

### DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Thor Power Tool Co., Aurora, Illinois

### DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Subland

Ace Drill Corp., Odrian, Michigan.  
pelier, Ohio.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Twist

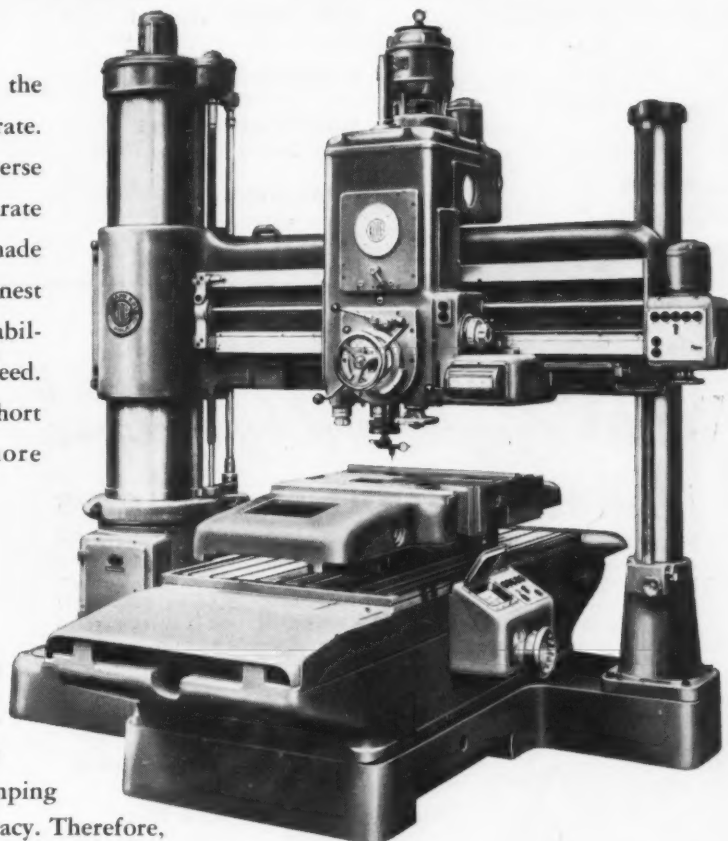
Ace Drill Corp., Adrian, Michigan.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.

(Continued on page 318)

# WITH A KOLB OPTICAL JIG BORER

YOU CAN POSITION A WORKPIECE  
TO WITHIN .00005" IN A FEW SECONDS

Positioning a workpiece on the Kolb jig borer is fast and accurate. It's fast because of rapid traverse with adjustable stops—it's accurate because the optical system is made by Leitz, one of Germany's finest optical manufacturers. Repeatability of the coordinates is guaranteed. By eliminating costly jigs, short run jobs can be handled more profitably.



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## D-F

## Product Directory

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Spiral Step Tool Co., Chicago 25, Ill.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLS, Wire**

Ace Drill Corp., Adrian, Michigan.  
Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., Cleveland, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DUPLICATORS**

Axelsson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.

Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**DUST COLLECTORS**

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Pangborn Corp., Hagerstown, Md.

**DUST CONTROL SYSTEMS**

Pangborn Corp., Hagerstown, Md.

**ELECTRICAL EQUIPMENT**

General Electric Co., Schenectady 5, N. Y.

**EMERY WHEEL DRESSERS**

See Dressers, Grinding Wheel

**EMERY WHEELS**

See Grinding Wheels

**END MILLS**

Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.  
National Twist Drill & Tool Co., Rochester, Mich.

**ENGRAVING MACHINES**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gorton, Geo., Mach., 1110 W. 13th St., Racine, Wis.

**EXTRACTORS, Screw**

Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**FACING MACHINES**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Michigan Drill Head Co., Detroit 34, Mich.  
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

**FANS, Exhaust, Electric Ventilating**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
General Electric Co., Schenectady 5, N. Y.

**FEEDS FOR PRESSES, Automatic**

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
Federal Press Co., Elkhart, Ind.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**FELT, For All Applications**

American Felt Co., Glenville, Conn.

**FILES, Hack**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Heller Tool Co., Newcomerstown, Ohio.  
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

**FILES, Hand**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Heller Tool Co., Newcomerstown, Ohio.  
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

**FILES, Machine**

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Heller Tool Co., Newcomerstown, Ohio.  
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILES AND BURS, Rotary**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Heller Tool Co., Newcomerstown, Ohio.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FILING MACHINES, Dies, Etc.**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILTERS, Coolant and Oil**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Commercial Filters Corp., Lebanon, Indiana  
Cuno Engineering Corp., Meriden, Conn.  
Industrial Filtration Co. (Delpark Corp.), 15 Industrial Ave., Lebanon, Ind.  
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

**FILTERS, Fire-resistant Fluids**

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

**FILTERS, Hydraulic Oils**

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

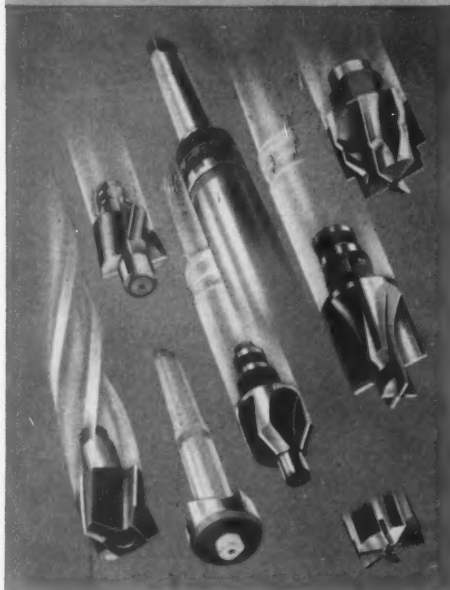
**FILTERS, Water**

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(Continued on page 320)

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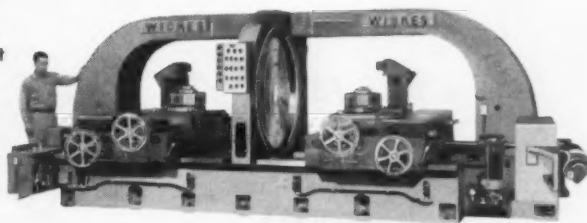
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both sides  
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machined  
both sides  
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MACHINERY, July, 1956—319

**FINISHES FOR MACHINE AND METAL PARTS**

Lowé Bros. Co., Dayton, Ohio.

**FLEXIBLE COUPLINGS**

See Couplings, Flexible

**FORGINGS, Machines (Upsetting)**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.  
American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Baldwin-Lima-Hamilton Corp., Eddystone Div.,  
Philadelphia 42, Pa.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2,  
Ohio.

**FORGINGS, Drop**

Bethlehem Steel Co., Bethlehem, Pa.  
Mueller Brass Co., Port Huron 35, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo  
7, N. Y.

**FORGINGS, Hollow Bored**

Bethlehem Steel Co., Bethlehem, Pa.  
National Forge & Ordnance Co., Irvine, Warren  
County, Pa.

**FORGINGS, Iron and Steel**

Bethlehem Steel Co., Bethlehem, Pa.  
National Forge & Ordnance Co., Irvine, Warren  
County, Pa.

**FORGINGS, Upset**

Bethlehem Steel Co., Bethlehem, Pa.  
Mueller Brass Co., Port Huron 35, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo  
7, N. Y.

**FORMING AND BENDING MACHINES**

Baldwin-Lima-Hamilton Corp., Eddystone Div.,  
Philadelphia 42, Pa.  
Bath, Cyril Co., Aurora & Solon Road, Solon,  
Ohio  
Bethlehem Steel Co., Bethlehem, Pa.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Cincinnati Milling Mch. Co., Oakley, Cincinnati  
9, Ohio.  
Cincinnati Shaper Co., Elam and Garrard Aves.,  
Cincinnati, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St.  
Clair Ave., N.E., Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Dreis & Krump Mfg. Co., 7416 Loomis Blvd.,  
Chicago 36, Ill.  
Erie Foundry Co., Erie, Pa.  
Federal Machine & Welder Co., Overland Ave.,  
Warren, Ohio.  
Ferrocut Machine Co., Bridgeton, N. J.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Eng. Corp., 470 Woodward Ave.,  
Buffalo, N. Y.  
Niagara Mch. & Tool Works, 683 Northland  
Ave., Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd St. & S. Ken-  
wood Ave., Chicago, Ill.  
Yoder Co., 5500 Walworth, Cleveland, Ohio.

**FORMING AND STAMPING MACHINES**

Baird Machine Co., 1700 Stratford Ave., Strat-  
ford, Conn.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton  
Div., Hamilton, Ohio.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Cincinnati Shaper Co., Elam and Garrard Aves.,  
Cincinnati, Ohio.  
Dreis & Krump Mfg. Co., 7416 Loomis Blvd.,  
Chicago 36, Ill.  
Federal Machine & Welder Co., Overland Ave.,  
Warren, Ohio.  
Federal Press Co., Elkhart, Ind.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Eng. Corp., 470 Woodward Ave.,  
Buffalo, N. Y.  
Niagara Mch. & Tool Works, 683 Northland  
Ave., Buffalo, N. Y.  
U. S. Tool Co., Inc., 255 North 18th St.,  
Ampere, N. J.  
Verson Allsteel Press Co., 93rd St. & S. Ken-  
wood Ave., Chicago, Ill.

**FORMING TOOLS or Tool Blanks**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Haynes Stellite Div., Union Carbide & Carbon  
Corp., 30 E. 42nd St., New York.  
Kennametal, Inc., Latrobe, Pa.  
National Broach & Mch. Co., 5600 St. Jean  
Ave., Detroit 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

**FRAMES, Machinery Welded**

Federal Machine & Welder Co., Overland Ave.,  
Warren, Ohio.  
Verson Allsteel Press Co., 93rd St. & S. Ken-  
wood Ave., Chicago, Ill.

**FURNACES, Heat-Treating**

Ajax Electric Company, Philadelphia, Pa.  
General Electric Co., Schenectady 5, N. Y.  
Holcroft and Co., 6545 Epworth Blvd., Detroit  
10, Mich.

**FURNITURE, Shop**

Standard Pressed Steel Co., Jenkintown, Pa.

**GAGE BLOCKS**

Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Pratt & Whitney Co., Inc., West Hartford,  
Conn.  
Scherr, George, Co., Inc., 200 Lafayette St.,  
New York 12, N. Y.

**GAGES, Air**

Cosa Corp., 405 Lexington Ave., New York 17.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Federal Products Corp., P. O. Box 1027, Provi-  
dence, R. I.  
Pratt & Whitney Co., Inc., West Hartford,  
Conn.  
Sheffield Corp., 721 Springfield St., Dayton 1,  
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## Product Directory

**GAGES, Comparator**

Ames, B. C., Co., Waltham 54, Mass.  
 Comfor Co., 47 Farwell St., Waltham 54, Mass.  
 Cosa Corp., 405 Lexington Ave., New York 17.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P.O. Box 1027, Providence, R. I.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.

**GAGES, Depth**

Ames, B. C., Co. (Dial), Waltham 54, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P. O. Box 1927, Providence, R. I.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.  
 Starrett, The L. S., Co., Athol, Mass.

**GAGES, Dial**

Ames, B. C., Co., Waltham 54, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P.O. Box 1027, Providence, R. I.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.  
 Starrett, The L. S., Co., Athol, Mass.

**GAGES, Electric**

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P.O. Box 1027, Providence, R. I.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**GAGES, Height**

Ames, B. C., Co., Waltham 54, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Starrett, The L. S., Co., Athol, Mass.

**GAGES, Plug, Ring and Snap**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P.O. Box 1027, Providence, R. I.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.  
 Kennametal Inc., Latrobe, Pa.  
 Metal Carbides Corp., Youngstown, Pa.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.  
 Starrett, The L. S., Co., Athol, Mass.  
 Winter Bros. Co., Rochester, Mich.

**GAGES, Surface**

Ames, B. C., Co., Waltham 54, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Starrett, The L. S., Co., Athol, Mass.

**GAGES, Taper**

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Starrett, The L. S., Co., Athol, Mass.

**GAGES, Thread**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Federal Products Corp., P.O. Box 1027, Providence, R. I.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Winter Bros. Co., Rochester, Mich.

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 Garlock Packing Co., Palmyra, N. Y.

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(Continued on page 322)



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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

#### GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.  
Eastman Kodak Co., Rochester, N. Y.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Starrett, The L. S., Co., Athol, Mass.

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Waltham Machine Works, Newton St., Waltham, Mass.

#### GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Barber-Colman Co., Rock and Montague, Rockford, Ill.  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.  
Lees-Bradner Co., Cleveland, Ohio.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

#### GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

#### GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.  
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).  
Lees-Bradner Co., Cleveland, Ohio.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

#### GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Lees-Bradner Co., Cleveland, Ohio.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Van Norman Co., Springfield, Mass.

#### GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

#### GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

#### GEAR MOTORS

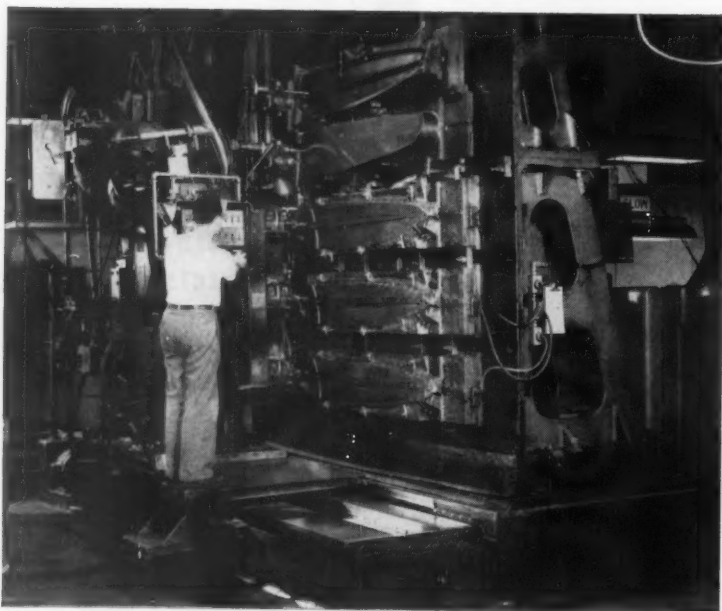
See Speed Reducers

#### GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(Continued on page 324)

## Walker Does it Again -



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.

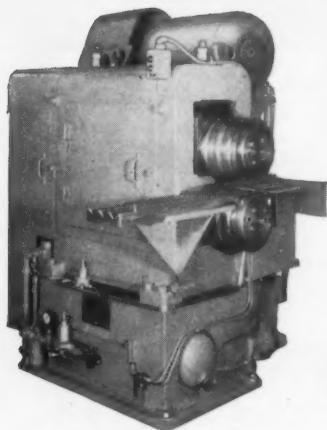
# O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

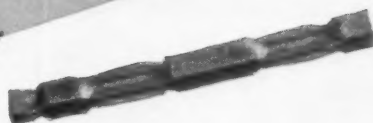
*Original Designers and Builders of Magnetic Chucks*

IN CANADA—UPTON BRADEEN & JAMES, LTD.





*from the forging roll . . .*



## **AJAX** WIDE ADJUSTMENT **FORGING ROLLS**

**PRE-ROLL YOUR FORGING BLANKS . . .**

**FOR METAL SAVING • LONGER DIE LIFE • BETTER FIBRE FLOW**

**AJAX ROLLS** are built in seven sizes to pre-roll forging blanks ranging from Connecting Rod blanks to the largest Airplane Propellers. Illustrations show Automobile Connecting Rod blank formed (above) and press-forged (below) on **AJAX HIGH SPEED FORGING PRESS**.

*. . . to the forging press*



WRITE FOR BULLETIN 91-B

THE **Ajax**

**MANUFACTURING COMPANY**  
EUCLID BRANCH P. O. CLEVELAND 17, OHIO  
110 S. DEARBORN ST., CHICAGO 3, ILLINOIS  
W. P. WOOLDRIDGE CO. • BURLINGAME, CAL. • LOS ANGELES 22, CAL.

# SOUTH BEND LATHE ATTACHMENTS

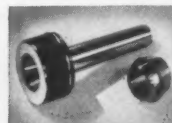
- Increase Lathe Versatility
- Simplify Difficult Jobs
- Perform Special Classes of Work



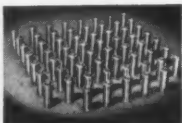
Handlever Collet Attachment



Duplex Turret Tool Holder



Adjustable Collet Bushing Chuck



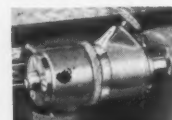
Steel and Brass Collets



Dial Indicator Carriage Stop



Telescoping Jaw Follower Rest and Center Rest



Micrometer Carriage Stop



Handwheel Collet Attachment



Milling Attachment



Ball Bearing Live Center



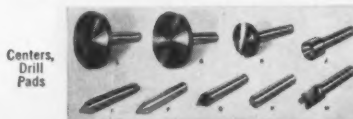
10 in 1 Tool Holder



Thread Indicator



External Grinder



Centers, Drill Pads

Write for Catalog 5600  
**SOUTH BEND LATHE**

Building Better Tools Since 1906  
South Bend 22, Indiana

G

## Product Directory

### GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Eastman Kodak Co., Rochester, N. Y.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Lees-Bradner Co., Cleveland, Ohio.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

### GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.  
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Brad Foote Gear Wks., 1309 So. Cicero Ave., Chicago 50, Ill.  
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.  
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.  
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.  
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.  
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.  
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.  
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.  
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.  
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.  
Lees-Bradner Co., Cleveland, Ohio.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.  
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.  
Verson Aalsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.  
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.  
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.  
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.  
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.  
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.  
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.  
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

### GEARS, Stamped

Winzler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

### GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.  
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.  
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

### GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

### GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.  
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.  
Shell Oil Co., 50 W. 50th St., New York, N. Y.  
Sinclair Refining Co., 600 5th Ave., New York, N. Y.  
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.  
Sun Oil Co., 1608 Walnut St., Philadelphia.  
Texas Co., 135 E. 42nd St., New York, N. Y.

### GRINDERS, Carbide Tool

See Grinding Machines, Carbide Tool

### GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

### GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

### GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Madison-Kipp Corp., Madison, Wis.  
Thor Power Tool Co., Aurora, Illinois.

### GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
Thor Power Tool Co., Aurora, Illinois.

### GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.

### GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Mattison Mch. Works, Rockford, Ill.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

### GRINDING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.  
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
Sterling Grinding Wheel Co., Tiffin, Ohio  
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

### GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.  
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

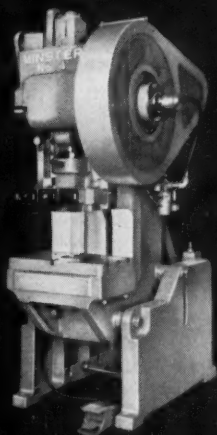
### GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.  
Norton Co., 1 New Bond St., Worcester 6, Mass.

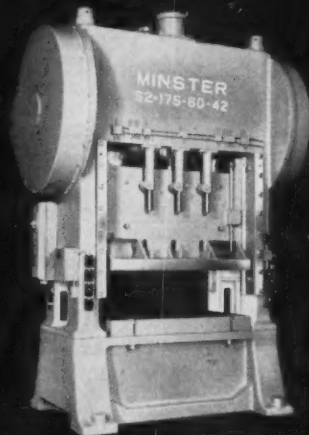
(Continued on page 326)

# MINSTER PRESSES

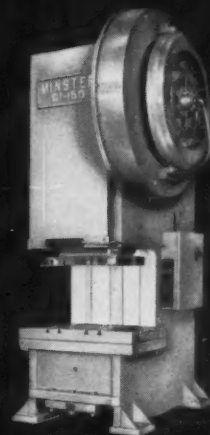
mean less die repair, less scrap, less down time



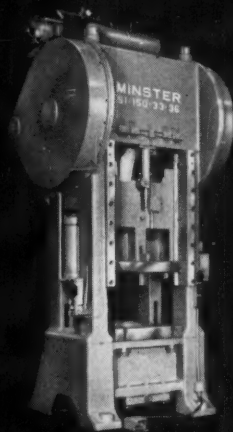
*Open Back Inclined Presses*  
12 tons through 200 tons



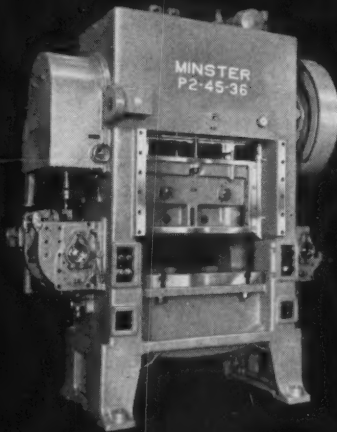
*Straight Side Two Point Presses*  
50 tons through 500 tons



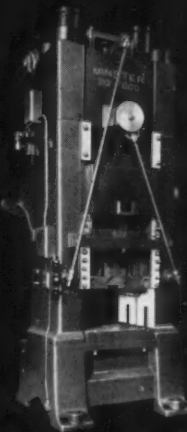
*Fixed Base Single Point Presses*  
32 tons through 200 tons



*Straight Side Single Point Presses*  
50 tons through 600 tons



*Piece-Maker Automatic Presses*  
20 tons through 200 tons



*Knuckle Joint Embossing Presses*  
150 tons through 1500 tons

Minster Press Lines not shown above:

Two Point Gap Presses inclinable or Fixed Base, 22 tons through 75 tons

Horning Presses, 12 tons through 95 tons.

THE MINSTER MACHINE COMPANY

Minster, Ohio

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**GRINDING MACHINES, Carbide Tool**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.  
 Carboly Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

**GRINDING MACHINES, Centerless**

Cincinnati Grinders, Inc., Cincinnati, Ohio.  
 Heid Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Landis Tool Co., Waynesboro, Pa.  
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.  
 Van Norman Co., Springfield, Mass.

**GRINDING MACHINES, Chucking**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.  
 Bullard Co., Brewster St., Bridgeport, Conn.  
 Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Crankshaft**

Landis Tool Co., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.

**GRINDING MACHINES, Cylindrical**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Grinders, Inc., Cincinnati, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.  
 Landis Tool Co., Inc., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Van Norman Co., 2640 Main St., Springfield 7, Mass.

**GRINDING MACHINES, Die Chaser**

Eastern Mch. Screw Corp., New Haven, Conn.  
 Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Disc**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Mattison Machine Works, Rockford, Ill.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**GRINDING MACHINES, Drill**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**GRINDING MACHINES, Face**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
 Mattison Machine Works, Rockford, Ill.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

**GRINDING MACHINES, Flexible Shaft**

See Flexible Shaft Equipment

**GRINDING MACHINES, Gap**

Cincinnati Grinders, Inc., Cincinnati, Ohio.  
 Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Gear Tooth**

See Gear Grinding Machines

**GRINDING MACHINES For Sharpening**

**Cutters, Reamers, Hobbs, Etc.**

Barber-Colman Co., Rock and Montague, Rockford, Ill.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling Mch. Co., Cincinnati, Ohio.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
 Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Landis Tool Co., Waynesboro, Pa.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

**GRINDING MACHINES, For Sharpening**

**Turning and Planing Tools**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 (Continued on page 328)

PRECISION MOTOR-DRIVEN  
SPINDLES OR  
WORKHEADS

**RUGGED  
CONSTRUCTION**  
*Plus*  
**DYNAMIC BALANCE**  
*Plus*  
**PRECISE ENGINEERING  
OF STANDARD  
SPINDLES**  
*Equals*  
**SPECIAL  
MACHINE TOOL  
PERFECTION!**

PRECISION BELT-DRIVEN  
SPINDLES OR  
WORKHEADS



In nearly 500 American and foreign plants, STANDARD spindles are doing a top production job as modernizing applications on old machines, and in special adaptation for custom jobs.

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Our custom engineering department has or will get the answer for you. Tell us about it today —you'll get RESULTS that mean LOWER COST— GREATER PRODUCTION!

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PRECISION SPINDLES AND MACHINE TOOLS

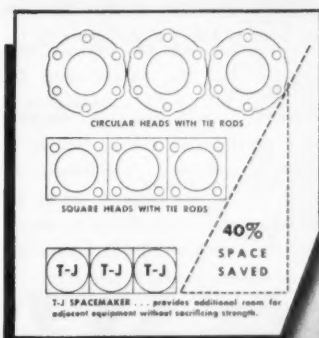
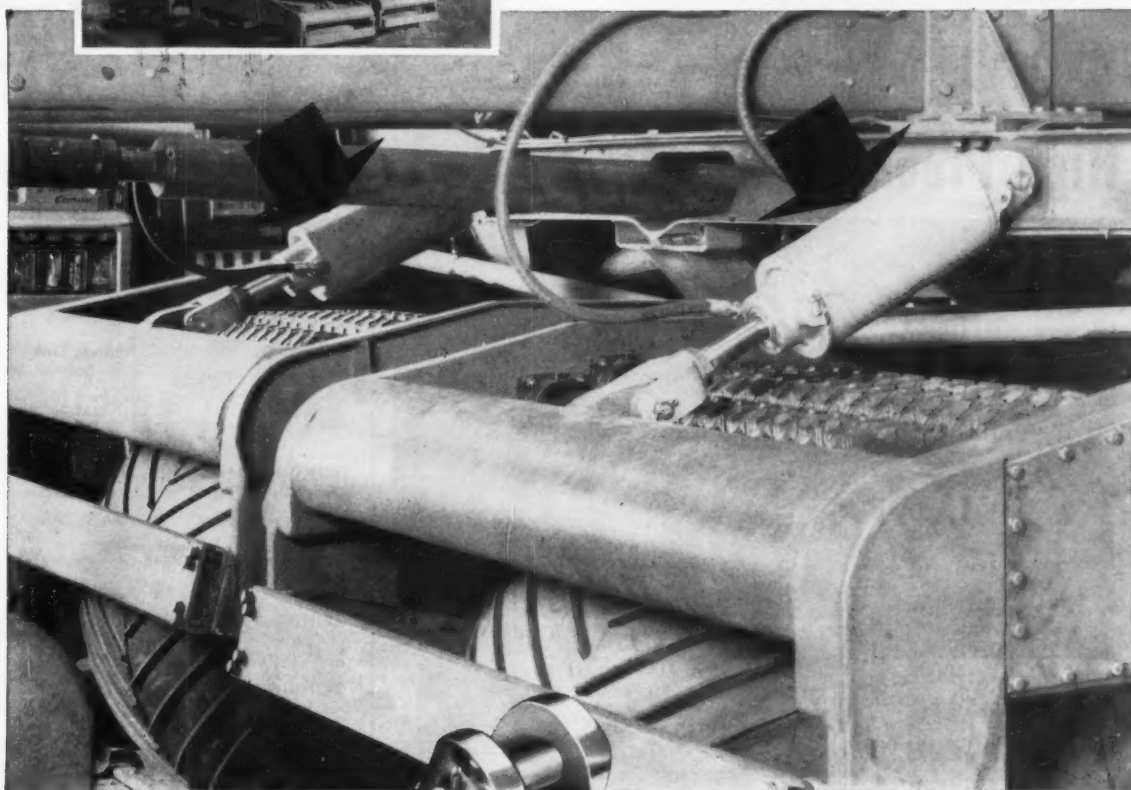
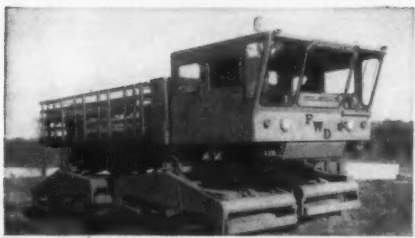
2500 RIVER ROAD CINCINNATI 4, OHIO

Since 1912



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## T-J Spacemaker CYLINDERS



**ALL MODELS...  
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DELIVERY**

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### Saves 40% Space! No Tie Rods For Greater Strength

Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Tera-cruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.)... and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities... 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.



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RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLIMBERS

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
 Walker, O. S., Co., Inc., Worcester, Mass.  
 Waltham Machine Works, Newton St., Waltham, Mass.

#### GRINDING MACHINES, Internal

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.  
 Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.

Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
 Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

#### GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.

#### GRINDING MACHINES, Knife and Shear Blade

Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
 Mattison Machine Works, Rockford, Ill.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

#### GRINDING MACHINES, Piston Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Mattison Machine Works, Rockford, Ill.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

#### GRINDING MACHINES, Profile

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

#### GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.  
 Van Norman Co., Springfield, Mass.

#### GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.  
 Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

#### GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Mattison Machine Works, Rockford, Ill.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

#### GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
 Farrell-Birmingham Co., 25 Main St., Ansonia, Conn.  
 Landis Tool Co., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.

#### GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

#### GRINDING MACHINES, Surface

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)  
 Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Blanchard Machine Co., 64 State St., Cambridge, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Galmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.  
 Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
 Mattison Machine Works, Rockford, Ill.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Reid Bros. Co., Inc., Beverly, Mass.  
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.  
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.  
 Walker, O. S., Co., Inc., Worcester, Mass.

#### GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

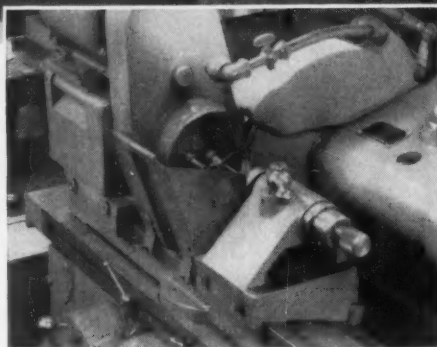
(Continued on page 330)

## High Precision Production Here



**ARTER**

Using diamond wheel to grind O.D. of a solid carbide 1/16" diameter end mill—dead center work head used.



Twelve of a battery of twenty-four Arter Model 103 cylindrical grinders in the highly modern plant of The Atrax Company, Newington, Conn. This nationally known progressive company produces precision ground carbide tools—end mills,

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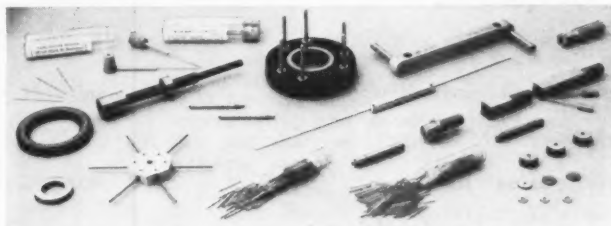
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We lap flat and cylindrical work in both metals and non-metals. Sealing rings and plates for pumps and pres-

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 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
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 Sterling Grinding Wheel Co., Tiffin, Ohio

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 Gleason Works, 1000 University Ave., Rochester, N. Y.  
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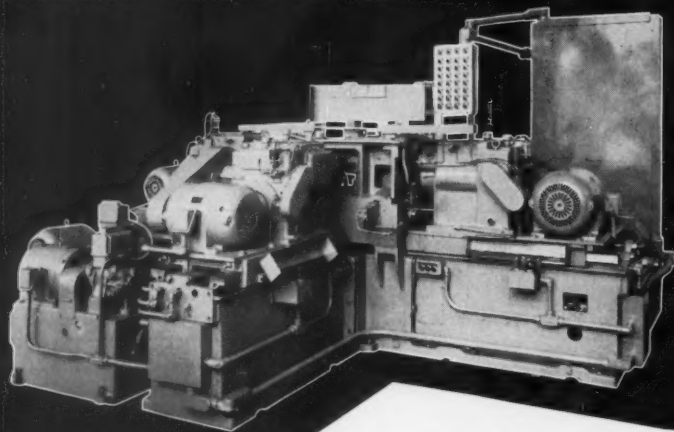
Barber-Colman Co., Rock and Montague, Rockford, Ill.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Lees-Bradner Co., Cleveland, Ohio.  
 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
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(Continued on page 332)

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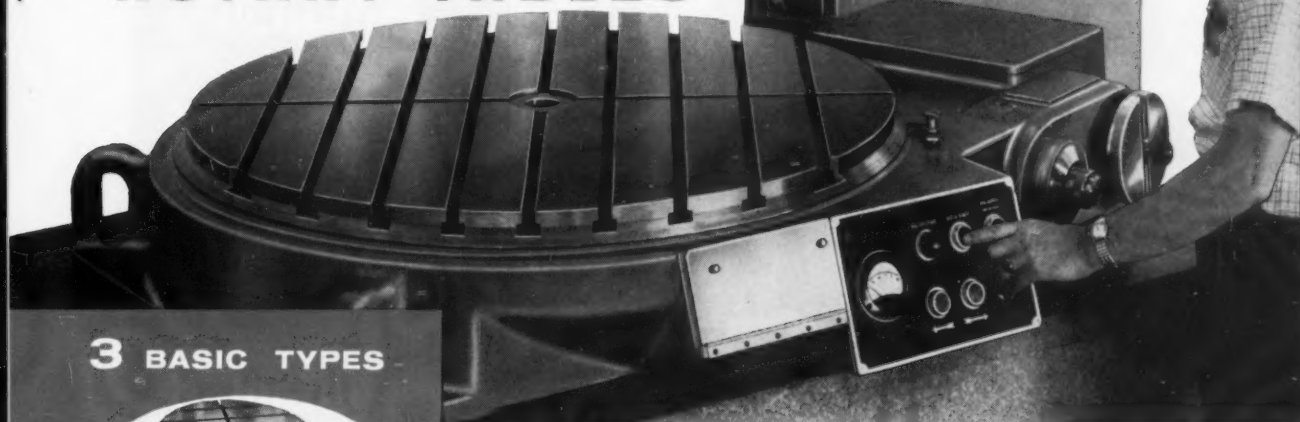
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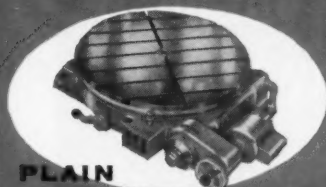


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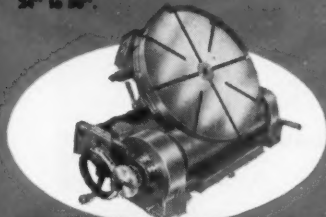


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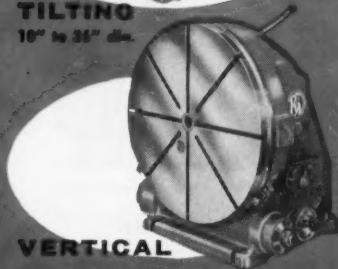
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Chambersburg Engrg. Co., Chambersburg, Pa.  
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Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.  
Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
Michigan Drill Head Co., Detroit 34, Mich.  
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.  
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.  
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.  
Wilson, K. R., Inc., 211 Mill St., Arcade N. Y.

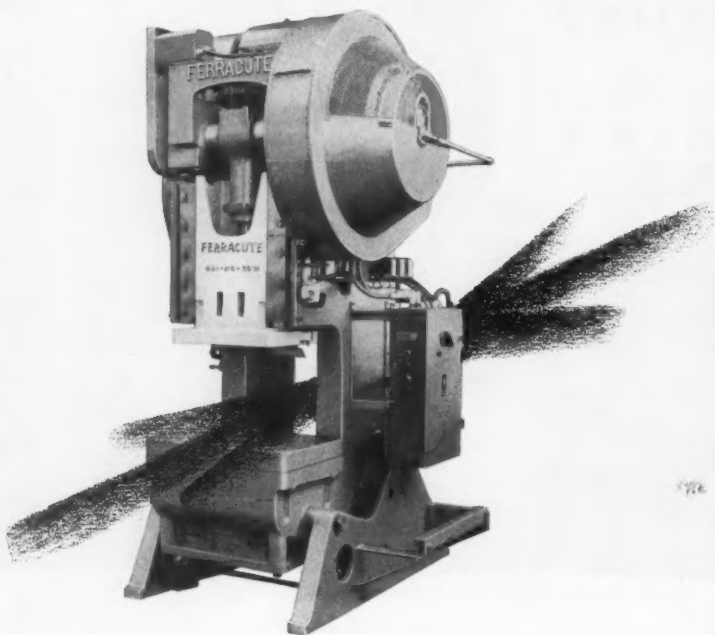
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Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.  
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.  
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Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Michigan Drill Head Co., Detroit 34, Mich.  
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(Continued on page 334)



110-Ton Model

● AIR CLUTCH ● INTERCONNECTED BRAKE ● BOX TYPE RAM ●  
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ON FERRACUTE

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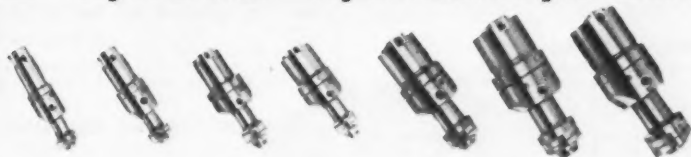
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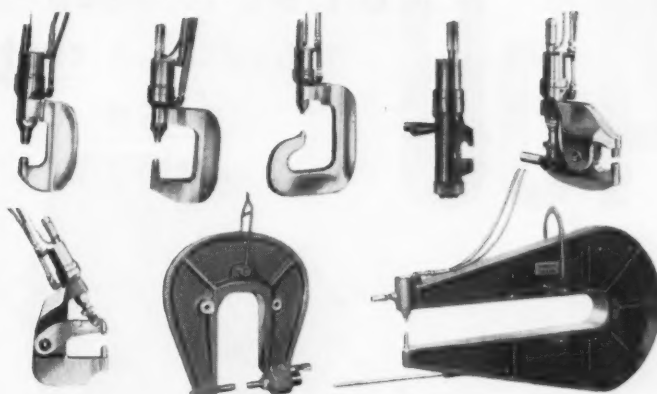
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Hannifin supplies "Hy-Power" Hydraulic Cylinders in 7½ to 100-ton capacities (more in multiple) to exert the force exactly when and where you want it.

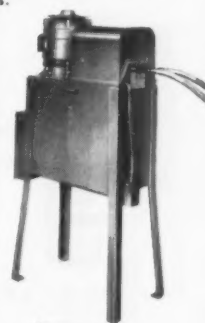
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MACHINERY, July, 1956—333

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
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Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.  
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

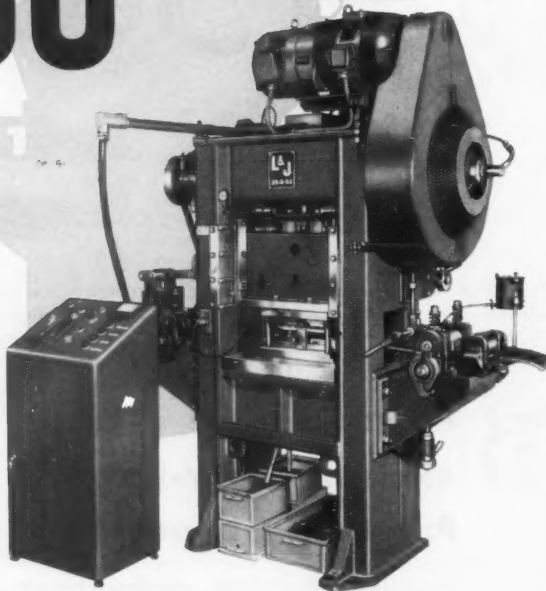
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(Continued on page 336)

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Speed, strokes per min.	150-450	150-450	150-300	150-300
Die space, standard	11"	11"	12"	12"
Ram area	24" x 12"	24" x 12"	36" x 20"	36" x 20"
Bolster plate	24" x 19"	24" x 19"	36" x 24"	36" x 24"
Stroke lengths, standard	1"-2"	1"-2"	1"-3"	1"-3"
Ram adjustment (ratchet)	2"	2"	2"	2"



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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.  
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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sidney Machine Tool Co., Sidney, Ohio.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Springfield Mch. Tool Co., Springfield, Ohio.  
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

**LATHES, Automatic**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Cone Automatic Mch. Co., Inc., Windsor, Vt.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Goss & DeLoeue Mch. Co., Kensington, Conn.  
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.  
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Axle**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**LATHES, Bench**

Atlas Press Co., Kalamazoo, Mich.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Levin, Louis & Son, Los Angeles 21, Calif.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

**LATHES, Boring**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
Sidney Machine Tool Co., Sidney, Ohio.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Crankshaft**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

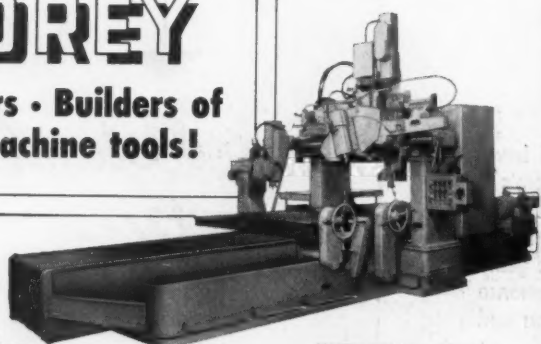
**LATHES, Double-End**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Duplicating**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.  
Sidney Machine Tool Co., Sidney, Ohio.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

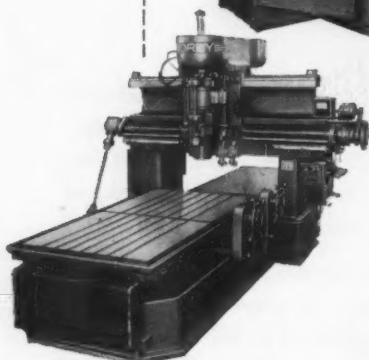
(Continued on page 338)

**MOREY****Designers • Builders of  
fine machine tools!**

MOREY 50M "Aeroframe"  
Profile Milling Machine  
with tilting head

**MOREY 50 MA "Aeroframe" Profiler****and Milling Machine**

Drive motor—40/20 HP, 3600/1800 RPM  
18 spindle speeds from 44 to 4800 RPM  
Table sizes: Width 36"—48"—72"  
Length from 48" in increments of 2"  
Distance between columns—66"  
Vertical movement of spindle (power and hand)—8"  
Distance between table and spindle—14" or 21"  
Power feeds to table and saddle available in ranges 2"-160" or 4"-320"/min.  
Also available: automatic tilting head in accordance with AIA specifications, horizontal milling attachment, variable angle milling cutter.



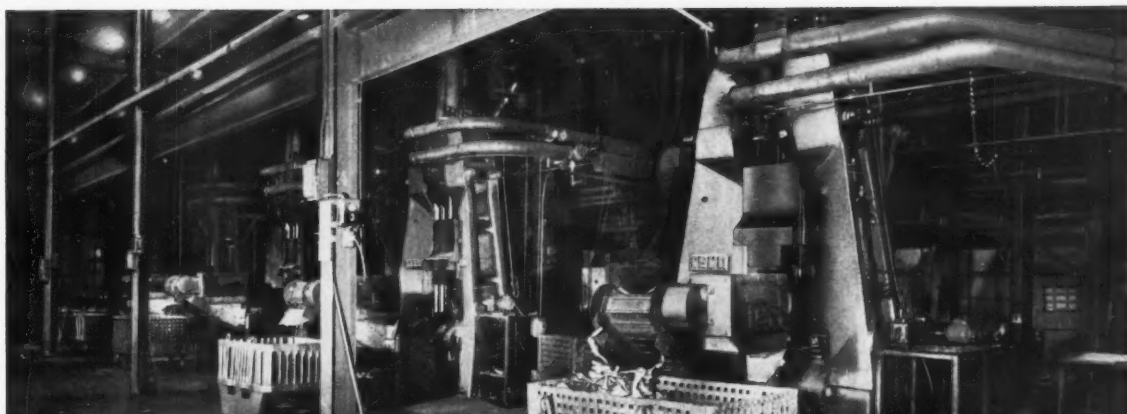
- TURRET LATHES
- VERTICAL SHAPERS
- AUTOMATIC LATHES
- PROFILE MILLING MACHINES

Also . . . Special Milling Machines for sculpturing airframe forgings  
Milling Machines for spars and wings

For complete information on any Morey  
Machine Tool write now to Dept. MT

**MOREY****MOREY MACHINERY CO., INC.**

Builders and Distributors of Fine Machine Tools  
383 LAFAYETTE STREET, NEW YORK 3, N. Y.  
ALgonquin 4-4540 • Cable Address: Woodwork, N. Y.



Four of six Ceco-Drops which replaced Board Hammers in a large automobile forge shop

• **CECO-DROP.**

The Ceco-Drop was selected because of better maintenance record and ease of operation



High production is maintained—there are no boards to change—fewer adjustments to make

• **CECO-DROP.**

The Ceco-Drop is safer and easier to operate. "Leg fatigue" is eliminated. There are no overhead hazards



Parts shown here are typical Ceco-Drop forgings

• **CECO-DROP.**

They are automobile shock absorber parts—pitman, anchor and arms

Have you the latest CECO-DROP bulletin? Write CHAMBERSBURG ENGINEERING COMPANY, Chambersburg, Pa.

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—337

**LATHES, Engine and Toolroom**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.  
 Atlas Press Co., Kalamazoo, Mich.  
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
 Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.  
 Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y.  
 Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.

Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
 Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
 Sidney Machine Tool Co., Sidney, Ohio.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Springfield Mch. Tool Co., Springfield, Ohio.  
 Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Gap**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
 Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Sidney Machine Tool Co., Sidney, Ohio.

Springfield Mch. Tool Co., Springfield, Ohio.  
 Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

**LATHES, Gun**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Springfield Machine Tool Co., Springfield, Ohio.  
 Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Hollow Spindle**

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

**LATHES, Manufacturing Type**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.  
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

**LATHES, Spinning**

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.  
 Ferracute Machine Co., Bridgeton, N. J.

**LATHES, Toolroom**

See Lathes, Engine and Toolroom

**LATHES, Turret**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Bullard Co., Brewster St., Bridgeport 2, Conn.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.  
 Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y.  
 Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.  
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Springfield Mch. Tool Co., Springfield, Ohio.  
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.  
 Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

**LATHES, Vertical Turret**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Baird Machine Co. 1700 Stratford Ave., Stratford, Conn.  
 Bullard Co., Brewster St., Bridgeport 2, Conn.

**LAYOUT FLUID**

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

**LEVELS**

Bullard Co., Brewster St., Bridgeport 2, Conn.  
 Starrett, The L. S., Co., Athol, Mass.

**LIGHTS, Indicator**

Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.

**LOCATORS, for Jig Bore**

Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

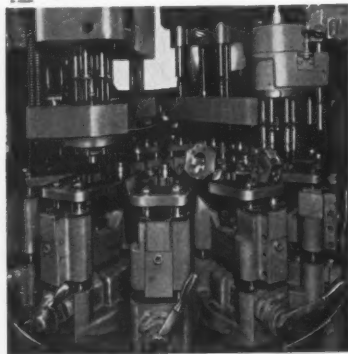
**LUBRICANTS, Including Extreme**

**Pressure (EP) Machinery Lubricants**  
 Cities Service Oil Co., 70 Pine St., New York, N. Y.  
 Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
 Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Sinclair Refining Co., 600 5th Ave., New York, N. Y.

# MILLHOLLAND

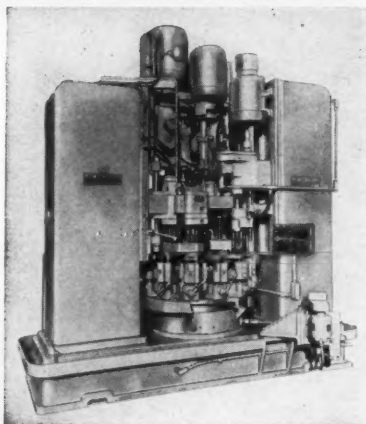
**12-Station Vertical****Indexing Machine**  
**34 Spindles!****93 Pieces per Hour!**

Here is Millholland versatility in action!

**Unique Holding Fixture**

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic



Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Part requirements dictated location using self-centering horizontal vees with up-acting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

Write for Bulletin M-7 giving further details.

**W. K. MILLHOLLAND MACHINERY CO.**  
**6402 Westfield Blvd. Indianapolis 20, Indiana**



## L-M

Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.  
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.  
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.  
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
Texas Co., 135 E. 42nd St., New York, N. Y.  
White & Bagley Co., Worcester, Mass.

## LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.  
Madison-Kipp Corp., Madison, Wis.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

## MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, etc.

## MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

## MANDRELS

See Arbors and Mandrels

## MARKING MACHINES AND DEVICES

Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.  
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.

## MASKS, PAINTING

Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

## MATERIALS HANDLING TRUCKS

Automatic Transportation Co., 133 W. 87th St., Chicago 20, Ill.

## MEASURING MACHINES AND INSTRUMENTS, Precision

Crane Packing Co., 1800 Cuyler Ave., Chicago.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Federal Products Corp., P.O. Box 1027, Providence, R. I.  
Norma-Hoffman Bearings Corp., Stamford, Conn.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
Starrett, The L. S. Co., Athol, Mass.

## METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

## METAL DISINTEGRATOR

Elox Corp., Royal Oak, Mich.

## METERS

See Recording Instruments

## MICROMETERS

Ames, B. C., Co. (Dial) Waltham 54, Mass.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Starrett, The L. S. Co., Athol, Mass.

## MICROSCOPES, Toolmakers

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

## MILLING ATTACHMENTS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling Machine Co., Cincinnati, Ohio.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Kempnath Machine Co., Milwaukee, Wis.

## Product Directory

Pratt & Whitney Co., Inc., West Hartford, Conn.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.  
Van Norman Co., 3640 Main St., Springfield 7, Mass.

## MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.  
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

## MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.  
Consolidated Machine Tool Corp., Rochester, N. Y.

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Springfield, Vt.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Jones & Lamson Mch. Co., 160 Clinton St., Kearney & Trecker Corp., Milwaukee, Wis.  
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

## MILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.  
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.  
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

(Continued on page 340)



Sheldon's larger, wider "Zero Inspection", Tapered Roller Spindle Bearings save you money by making these lathes better in 6 ways.

Write for G-55 catalog showing new 10" 11" and 13" swing, bench, cabinet and pedestal mounted Sheldon Precision lathes.

- 1st They meet Sheldon's high standard for accuracy—each bearing has a run out limited to .00015"
- 2nd They absorb thrust and radial loads beyond requirements—basic rating on front bearing at 500 R.P.M.
- 3rd They end costly bearing maintenance—require only a fractional turn of bearing take-up after long periods of service.
- 4th They hold the spindle in rigid alignment while permitting it to turn freely at high or low speeds—the line contact between rolls and races, and the opposing taper design, preclude lateral movement or end play.
- 5th They minimize friction—smooth mirror finished rollers and races running in light oil, deliver more horsepower at the Spindle Nose and lower power costs.
- 6th They increase work capacity. Larger than similar type bearings on other lathes in this price range, these bearings make it possible to turn out more work and better work at lower costs.

for radial loads. . . . . 3540 lbs.  
thrust loads. . . . . 2335 lbs.

## SHeldon MACHINE CO., INC.

4246 NORTH KNOX AVE. • CHICAGO 41, ILLINOIS

**MILLING MACHINES, Circular, Continuous**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
Davis & Thompson Co., 6411 W. Burnham St.,  
Milwaukee 14, Wis.  
Espin-Lucas Mch. Works, Front St., and Girard  
Ave., Philadelphia, Pa.  
Ingersoll Milling Mch. Co., 2442 Douglas St.,  
Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

**MILLING MACHINES, Duplex**

Cincinnati Milling Machine Co., Cincinnati,  
Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Espin-Lucas Mch. Works, Front St., and Girard  
Ave., Philadelphia, Pa.  
Ingersoll Milling Mch. Co., 2442 Douglas St.,  
Rockford, Ill.

Kearney & Trecker Corp., Milwaukee, Wis.  
Nichols-Morris Corp., 76 Mamaroneck Ave.,  
White Plains, N. Y.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.  
U. S. Tool Co., Inc., 255 North 18th St.,  
Ampere, N. J.

**MILLING MACHINES, Hand**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los  
Angeles 58, Cal.  
Nichols-Morris Corp., 76 Mamaroneck Ave.,  
White Plains, N. Y.  
U. S. Burke Machine Tool Div., Brotherton Rd.,  
Cincinnati 27, Ohio.  
U. S. Tool Co., Inc., 255 North 18th St.,  
Ampere, N. J.  
Van Norman Co., 3640 Main St., Springfield  
7, Mass.

## The MODERN AUTOMATIC CUTTING-OFF MACHINE

**Cuts Off Tubing, Pipe and Shafting . . . FAST**

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

**1 1/2" Tubing**

This machine cuts off and chamfers both outside edges of 1/2" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

**1 1/4" Cold Rolled**

This machine cuts off and chamfers both ends of 1 1/4" cold rolled, 20" long, at the rate of one every 20 seconds.

**1" Tubing**

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

**These popular, time saving machines are now available in four sizes, handling work up to 6 3/4" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.**

WRITE FOR ILLUSTRATED CATALOG

**MODERN MACHINE TOOL CO.**

Jackson, Michigan

**MILLING MACHINES, Horizontal, Plain And Universal**

American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Austin Industrial Corp., 76 Mamaroneck Ave.,  
White Plains, N. Y.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling Machine Co., Cincinnati,  
Ohio.  
Consolidated Machine Tool Corp., Rochester,  
N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17.  
Gorton, Geo., Mch. Co., 1110 W. 13th St.,  
Racine, Wis.  
Greaves Machine Tool Co., 2009 Eastern  
Avenue, Cincinnati, Ohio.  
Ingersoll Milling Mch. Co., 2442 Douglas St.,  
Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Kemp Smith Machine Co., Milwaukee, Wis.  
Sheldon Machine Co., Inc., 4240-4258 N. Knox  
Ave., Chicago 41, Ill.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.  
Van Norman Co., 3640 Main St., Springfield  
7, Mass.

**MILLING MACHINES, Lincoln Type**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

**MILLING MACHINE, Planer Type**

Baldwin-Lima-Hamilton Corp., Lima Hamilton  
Div., Hamilton, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Espin-Lucas Mch. Works, Front St., and Girard  
Ave., Philadelphia, Pa.  
Giddings & Lewis Machine Tool Co., Fond du  
Lac, Wis.  
Gray, G. A., Co., Woodburn Ave., and Penn.  
R. R., Evanston, Cincinnati, Ohio.  
Ingersoll Milling Mch. Co., 2442 Douglas St.,  
Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.

**MILLING MACHINES, Profile**

American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Cincinnati Milling Machine Co., Cincinnati,  
Ohio.  
Cosa Corp., 405 Lexington Ave., New York 17.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit  
32, Mich.  
Gorton, Geo., Mch. Co., 1110 W. 13th St.,  
Racine, Wis.  
Pratt & Whitney Co., Inc., West Hartford,  
Conn.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

**MILLING MACHINES, Ram Type Universal**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los  
Angeles 58, Cal.  
Van Norman Co., 3640 Main St., Springfield  
7, Mass.

**MILLING MACHINES, Turret Type**

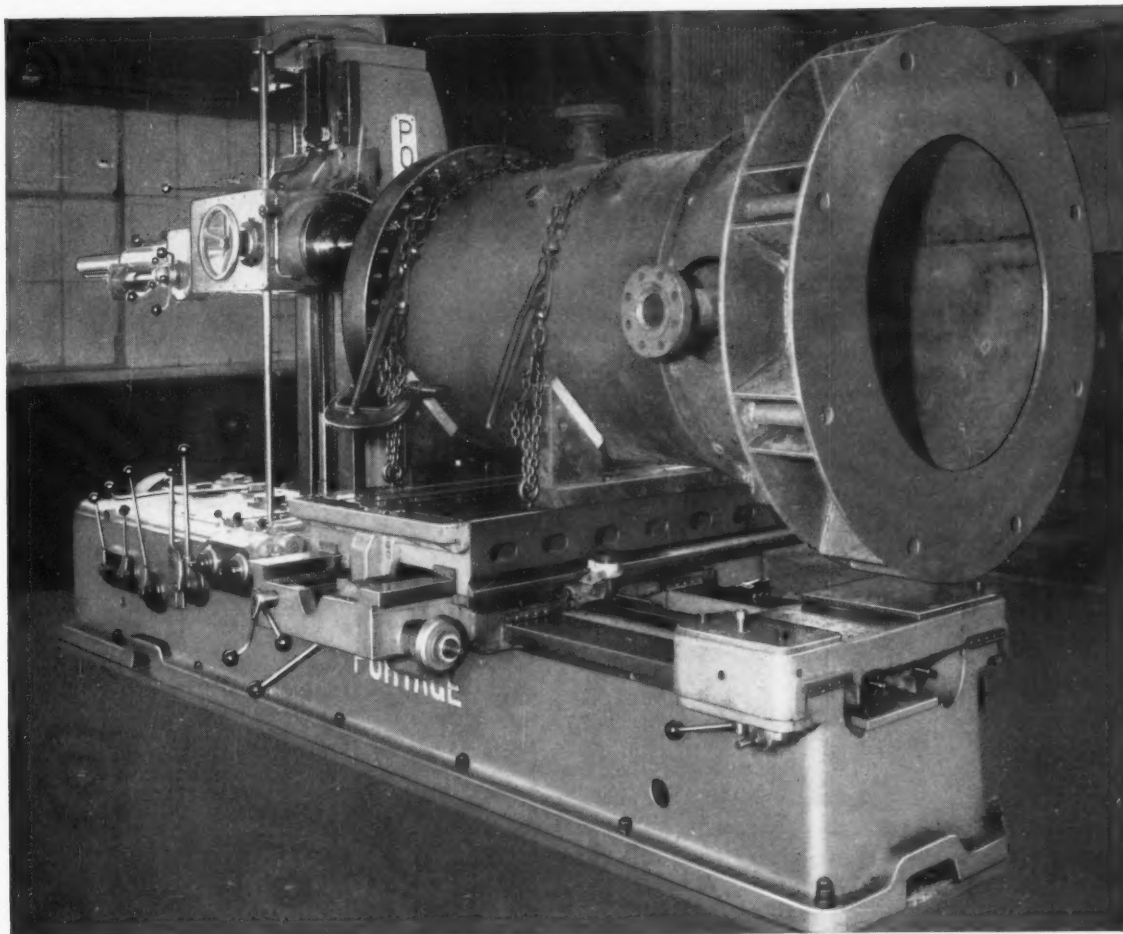
Axelson Mfg. Co., 6160 S. Boyle Ave., Los  
Angeles 58, Cal.  
Bridgeport Machine, Inc., Linley Ave., Bridge-  
port, Conn.

**MILLING MACHINES, Vertical**

American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Austin Industrial Corp., 76 Mamaroneck Ave.,  
White Plains, N. Y.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los  
Angeles 58, Cal.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling Machine Co., Cincinnati,  
Ohio.  
Consolidated Machine Tool Corp., Rochester,  
N. Y.  
Ekstrom, Carlson & Co., 1437 Railroad Ave.,  
Rockford, Ill.  
Gorton, Geo., Mch. Co., 1110 W. 13th St.,  
Racine, Wis.  
Ingersoll Milling Mch. Co., 2442 Douglas St.,  
Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.  
U. S. Burke Machine Tool Div., Cincinnati 27,  
Ohio.

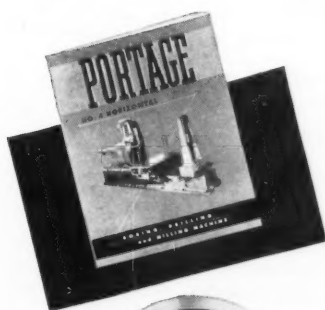
**MODEL AND EXPERIMENTAL WORK**

See Special Machinery and Tools  
(Continued on page 342)



Photograph courtesy of Western Supply Company, Tulsa, Oklahoma

## Read what this man has to say about **PORTAGE MILLS!**



Mr. D. W. Brady, Plant Manager of Western Supply Company, Tulsa, Oklahoma says,

"Our manufacturing facilities here at Western are devoted almost entirely to heat exchanger production. We have found the versatility of the Portage Mills allows us to do a wide variety of machining operations required in the fabrication of this type of work. We have found the machine to be very reliable and have experienced no lost time for repairs since it was installed."

Mr. Brady's kind remarks are typical of those coming in from across the country... PORTAGE MILLS are truly the *machine of the year*... and remember... Portage costs less to buy. Write for the illustrated catalog... and ask for a proposal too!



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Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—341

**MOLD AND DIE COPYING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
 Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
 Coss Corp., 405 Lexington Ave., New York 17.  
 Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.

**MOLDING MACHINES, Plastic**

Erie Foundry Co., Erie, Pa.  
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
 Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
 Vernon Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**MOLYBDENUM**

Climax Molybdenum Co., New York, N. Y.

**MOTORS, Electric**

General Electric Co., Schenectady, N. Y.  
 Howell Electric Motors Co., Howell, Mich.  
 Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

**MOTORS, Hydraulic**

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**MULTIPLE-SLIDE FORMING MACHINES**

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**NAMEPLATES**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

**NIBBLING MACHINES**

Wales-Strippert Corp., North Tonawanda, N. Y.

**NIPPLE THREADING MACHINERY**

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
 Landis Machine Co., Inc., Waynesboro, Pa.

**NUMBERING MACHINES**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

**NUT SETTING EQUIPMENT**

See Screw Driving and Nut Setting Equipment.

**NUT TAPPERS**

See Bolt and Nut Machinery.

**NUTS, Cold Forged, Wing and Cap**

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

**NUTS, Thumb or Wing and Cap**

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

**OIL CUPS**

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

**OIL EXTRACTORS AND CLEANERS**

De Laval Separator Co., Poughkeepsie, N. Y.

**OIL HOLE COVERS**

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

**OIL GROOVERS**

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

**OIL SEALS**

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.  
 Garlock Packing Co., Palmyra, N. Y.

**OILERS AND LUBRICATORS**

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois  
 Madison-Kipp Corp., Madison, Wis.

**OILS, Cutting**

See Cutting and Grinding Fluids.

**OILS, Lubricating**

Cities Service Oil Co., 70 Pine St., New York, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Sinclair Refining Co., 600 5th Ave., New York.  
 Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.  
 Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.  
 Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.  
 Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
 Texas Co., 135 E. 42nd St., New York, N. Y.

**OILS, Quenching and Tempering**

Cities Service Oil Co., 70 Pine St., New York, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Sinclair Refining Co., 600 5th Ave., New York.  
 Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.  
 Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.

**OILS, Soluble**

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

**OPTICAL FLATS**

Crane Packing Co., 1800 Cuyler Ave., Chicago.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**ORDNANCE MACHINES, Special**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.  
 Vernon Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**PACKING, Leather, Metal, Rubber Asbestos, Etc.**

Crane Packing Co., 1800 Cuyler Ave., Chicago.  
 Garlock Packing Co., Palmyra, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

**PAINTING EQUIPMENT, Spray**

Lowé Bros. Co., Dayton, Ohio.

**PARALLELS**

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Starrett, The L. S., Co., Athol, Mass.  
 Walker, O. S., Co., Inc., Worcester, Mass.

**PATTERNS, Wood and Metal**

Mummert-Dixon Co., Hanover, Pa.

**PILLOW BLOCKS**

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.  
 Norma-Hoffman Bearings Corp., Stamford, Conn.  
 Standard Pressed Steel Co., Jenkintown, Pa.

**PIPE, Brass and Copper**

American Brass Co., 25 Broadway, New York, N. Y.  
 American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Bridgeport Brass Co., Bridgeport, Conn.  
 Mueller Brass Co., Port Huron 35, Mich.  
 Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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 Phone SPalding 1-4600 Pittsburgh 25, Penn.



**PIPE, Steel**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.  
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

**PIPE THREADING AND CUTTING MACHINES**

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Lands Machine Co., Inc., Waynesboro, Pa.

**PIPE TONGS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**PLANNER ATTACHMENTS**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.  
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**PLANERS, Double Housing and Openside**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).  
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.  
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.  
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**PLATE ROLLS**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

**PLATES, Surface**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Challenge Machinery Co., Grand Haven, Mich.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Scharr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**PNEUMATIC EQUIPMENT**

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

**POLISHING LATHES AND MACHINES**

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

**POLISHING TOOLS, Portable**

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.  
Thor Power Tool Co., Aurora, Illinois

**POWER UNITS, Hydraulic**

See Hydraulic Power Units or Tool Heads

**PRESSES, Arbor**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
duMont Corp., Greenfield, Mass.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Threadwell Tap & Die Co., Greenfield, Mass.  
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**PRESSES, Broaching**

American Broach & Mch. Co., Ann Arbor, Mich.  
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Federal Press Co., Elkhart, Ind.  
Ferracute Machine Co., Bridgeton, N. J.  
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.  
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

**PRESSES, Extrusion**

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Federal Press Co., Elkhart, Ind.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

**PRESSES, Foot**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Ferracute Machine Co., Bridgeton, N. J.  
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

**PRESSES, Forging**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Ferracute Machine Co., Mount Gilead, Ohio.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**PRESSES, Hydraulic**

American Broach & Mch. Co., Ann Arbor, Mich.  
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.  
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.  
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.  
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.  
(Continued on page 344)



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A lot of production men have made such comments about this versatile little hydraulic press.

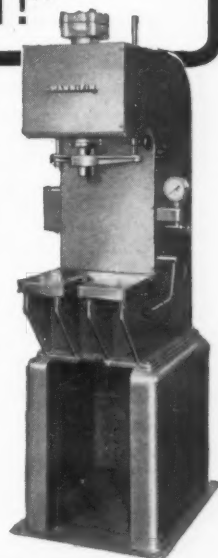
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Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Federal Mch. & Welder Co., Warren, Ohio.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.  
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**PRESSES, Screw**

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Ferracute Machine Co., Bridgeton, N. J.  
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

**PRESSES, Sheet Metal Working**

Allen, Alva F., Box 426, Clinton, Mo. (Bench)  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.  
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio.  
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Cincinnati Milling Mch. Co. Oakley, Cincinnati 9, Ohio.  
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.  
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Darnly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.  
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.  
Erie Foundry Co., Erie, Pa.  
Espin-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
Federal Press Co., Elkhart, Ind.  
Ferracute Machine Co., Bridgeton, N. J.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Johnson Machine & Press Corp., Elkhart, Ind.  
L & J Press Corp., Elkhart, Ind.  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
Minster Machine Co., Minster, Ohio.  
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.  
Wales-Strippet Corp., North Tonawanda, N. Y.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**PRESSES, Straightening**

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Dake Corp., 604 Seventh St., Grand Haven, Mich.  
Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo, N. Y.  
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.  
Springfield Mch. Tool Co., Springfield, Ohio.  
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**PROFILING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.  
Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**PULLEYS**

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

**PULLEYS, Friction Clutch**

Brown & Sharpe Mfg. Co., Providence, R. I.

**PUMPS, Coolant, Lubricant and Oil**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Rulman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Tamkins-Johnson Co., Jackson, Mich.  
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.  
Viking Pump Co., Cedar Falls, Iowa.

**PUMPS, Hydraulic**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.  
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.  
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.  
Viking Pump Co., Cedar Falls, Iowa.

**PUMPS, Pneumatic**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Ingersoll-Rand Co., Phillipsburg, N. J.

**PUMPS, Rotary**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.  
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.  
Viking Pump Co., Cedar Falls, Iowa.

**PUNCHES AND DIES**

See Dies, Sheet Metal, Etc.

**PUNCHES, Centering**

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

**PUNCHING MACHINERY**

Allen, Alva F., Box 426, Clinton, Mo.  
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio  
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Ferracute Machine Co., Bridgeton, N. J.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.  
Wales-Strippet Corp., North Tonawanda, N. Y.  
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

**RACKS, Gear Cut**

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.  
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.  
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.  
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

**REAMER HOLDERS**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Ward & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

**REAMERS**

Ace Drill Corp., Adrian, Michigan.  
Barber-Colman Co., Rock and Montague, Rockford, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**REAMERS, Adjustable**

Barber-Colman Co., Rock and Montague, Rockford, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
McCroskey Tool Corp., 1938 Thomas St., Meadville, Pa.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**REAMERS, Taper Pin**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Kaufman Manufacturing Co., Manitowoc, Wis.  
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**REAMING MACHINES**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.  
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Kaufman Manufacturing Co., Manitowoc, Wis.  
Michigan Drill Head Co., Detroit 34, Mich.  
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**RECORDING INSTRUMENTS**

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.

**REELS, Stock, Standard and Automatic**

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**REFRACTORS, Heat-Treating Furnace**

Norton Co., 1 New Bond St., Worcester 6, Mass.

(Continued on page 346)

# **FEDERAL WELDING PRESS . . .**

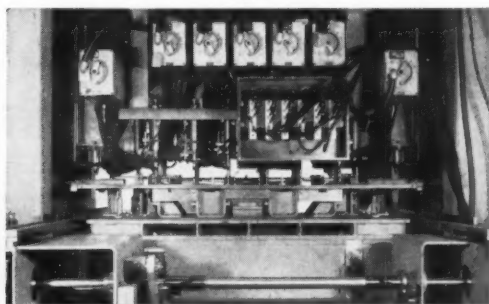
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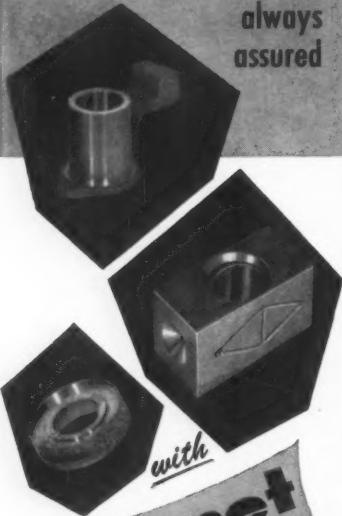
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CITY & STATE \_\_\_\_\_

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General Electric Co., Schenectady, N. Y.

### REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York,  
N. Y.

### RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia,  
Pa.  
Waldes-Kohinoor, Inc., 4716 Austel Place,  
Long Island City 1, N. Y.

### RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee,  
Wis.  
General Electric Co., Schenectady, N. Y.

### RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.  
Cleveland Punch & Shear Works Co., 3917 St.  
Clair Ave., N. E., Cleveland, Ohio.

### RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.  
Chicago Pneumatic Tool Co., 6 E. 44th St.,  
New York, N. Y.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
Ill.

### RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St.,  
New York, N. Y.  
Grant Mfg. & Machine Co., 90 Silliman St.,  
Bridgeport 5, Conn.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.  
Thor Power Tool Co., Aurora, Illinois  
Wood & Co., R. D. Public Ledger Bldg.,  
Philadelphia, Pa.

### RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo,  
N. Y.  
Grant Mfg. & Machine Co., 90 Silliman St.,  
Bridgeport 5, Conn.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
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Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
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Tomkins-Johnson Co., Jackson, Mich.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.

### RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2,  
Ohio.

### RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

### RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.  
Scherr, George Co., Inc., 200 Lafayette St.,  
New York 12, N. Y.  
Starrett, The L. S. Co., Athol, Mass.

### RUST PREVENTIVES

Houghton, E. F. & Co., 303 W. Lehigh Ave.,  
Philadelphia, Pa.  
Oakite Products, Inc., 19 Rector St., New York,  
N. Y.  
Scherr, George Co., Inc., 200 Lafayette St.,  
New York 12, N. Y.

### SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

### SANDERS

Chicago Pneumatic Tool Co., 6 E. 44th St.,  
New York, N. Y.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Maffison Machine Works, Rockford, Ill.  
Sundstrand Machine Tool Co., 2531 11th St.,  
Rockford, Ill.  
Thor Power Tool Co., Aurora, Illinois.

### SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
dale Ave., Chicago, Ill.

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.  
Starrett, The L. S. Co., Athol, Mass.

### SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and  
Girard Ave., Philadelphia, Pa.  
Match & Merryweather Mchry Co., Penton  
Bldg., Cleveland, Ohio.  
Scherr, George Co., Inc., 200 Lafayette St.,  
New York 12, N. Y.

### SAWING MACHINES, Circular

Consolidated Mch Tool Corp., Rochester, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17,  
N. Y.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
6146 N. Lexington Ave., Pittsburgh 8, Pa.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Espen-Lucas Machine Works, Front St. and  
Girard Ave., Philadelphia, Pa.  
Match & Merryweather Mchry Co., Penton  
Bldg., Cleveland, Ohio.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.  
Triplex Machine Tool Corp., 75 West St., New  
York 6, N. Y.

### SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.

### SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
dale Ave., Chicago, Ill.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.  
Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.  
Walker-Turner Div., Kearney & Trecker Corp.,  
South Ave., Plainfield, N. J.

### SAWING MACHINES, Power Hack

American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
dale Ave., Chicago, Ill.  
Austin Industrial Corp., 76 Mamaroneck Ave.,  
White Plains, N. Y.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.

### SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co., Providence, R. I.  
Circular Tool Co., Inc., 765 Allens Ave., Provi-  
dence 5, R. I.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Espen-Lucas Machine Works, Front St. and  
Girard Ave., Philadelphia, Pa.  
Match & Merryweather Mchry Co., Penton  
Bldg., Cleveland, Ohio.  
National Twist Drill & Tool Co., & Winter  
Bros. & Co., Rochester, Mich.  
Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.  
Triplex Machine Tool Corp., 75 West St., New  
York 6, N. Y.

### SAWS, Metal Cutting Band

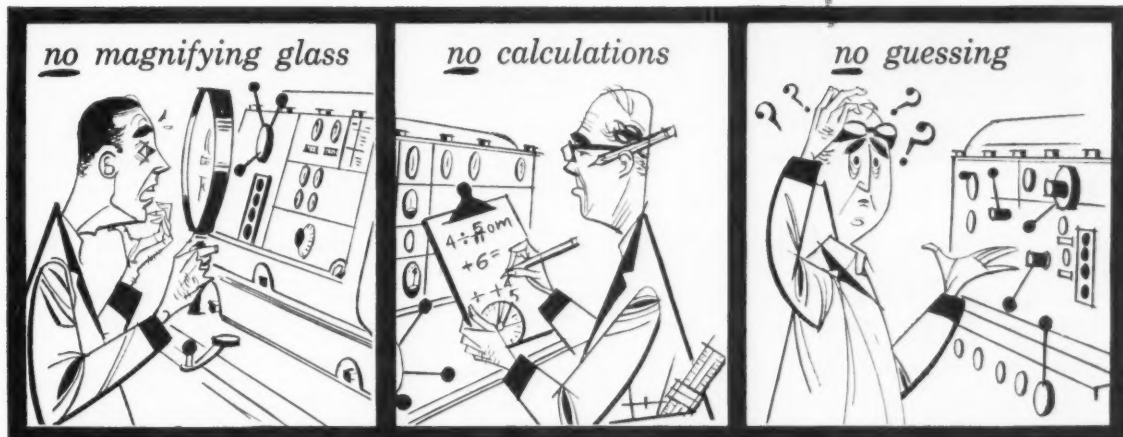
Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
dale Ave., Chicago, Ill.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Johnson Mfg. Co., Albion, Mich.  
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.  
Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.  
Starrett, The L. S. Co., Athol, Mass.

### SAWS, Portable Electric

Thor Power Tool Co., Aurora, Illinois



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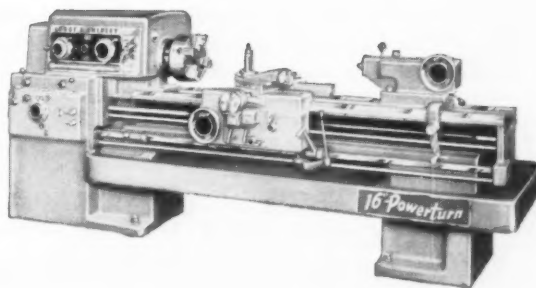
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Brown & Sharpe Mfg. Co., Providence, R. I.  
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.  
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.  
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.  
Starrett, The L. S. Co., Athol, Mass.

### SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

### SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
Ingersoll-Rand Co., Phillipsburg, N. J.  
Thor Power Tool Co., Aurora, Illinois

### SCREW DRIVING AND NUT SETTING EQUIPMENT

Ingersoll-Rand Co., Phillipsburg, N. J.  
Thor Power Tool Co., Aurora, Illinois

### SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.  
Pruitt & Whitney Co., Inc., West Hartford, Conn.  
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.  
Reed Rolled Thread Die Co., P.O. Box 350, Worcester, Mass.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### SCREW MACHINE WORK

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Mueller Brass Co., Port Huron 35, Mich.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Ottemiller, M. H. Co., York, Pa.  
Standard Pressed Steel Co., Jenkintown, Pa.  
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

### SCREW MACHINES, Automatic

#### Single and Multiple Spindle

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.  
Cons Automatic Mch. Co., Inc., Windsor, Vt.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gorton, George, Mch Co., 1110 W. 13th St., Racine, Wis.  
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Scherer, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.

### SCREW MACHINES, Hand

#### See also Lathes, Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.  
Threadwell Tap & Die Co., Greenfield, Mass.

### SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Ottemiller, W. H. Co., York, Pa.  
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.  
Russell, Burdall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.  
Standard Pressed Steel Co., Jenkintown, Pa.

### SCREWS, Self-Tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

### SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.  
Russell, Burdall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois  
Garlock Packing Co., Palmyra, N. Y.

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Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.  
Miles Machinery Co., Box 770, Saginaw, Mich.

### SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

### SEPARATORS, Oil or Coolant

Barnes Drill Co., (Magnetic), 814 Chestnut, Rockford, Ill.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

### SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.  
Cumberland Steel Co., Cumberland, Md.  
De Laval Separator Co., Poughkeepsie, N. Y.  
Ryersson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.  
Standard Pressed Steel Co., Jenkintown, Pa.

### SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

### SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.  
Cumberland Steel Co., Cumberland, Md.  
National Forge & Ordnance Co., Irvine, Warren County, Pa.  
Ryersson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

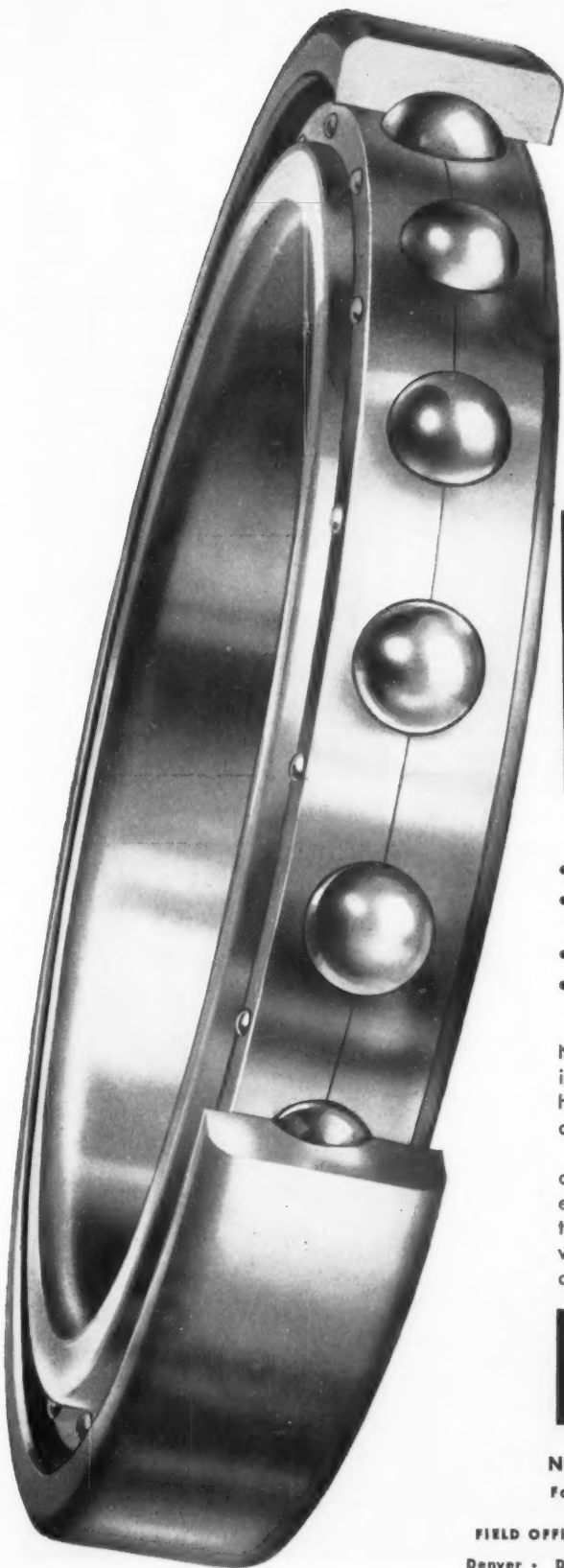
### SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

### SHAPERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.  
Atlas Press Co., Kalamazoo, Mich.  
Austin Industrial Corp., 76 Mamaronck Ave., White Plains, N. Y.  
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

(Continued on page 350)



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MACHINERY, July, 1956—349

**S**

**Product Directory**

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 4, Ill.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

**SHAPERS, Vertical**

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**SHAPERS, Structural**

Bethlehem Steel Co., Bethlehem, Pa.  
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

**SHEARING MACHINERY**

Bethlehem Steel Co., Bethlehem, Pa.  
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Ferracute Machine Co., Bridgeton, N. J.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.  
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

**SHEARS, Alligator**

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

**SHEARS, Rotary**

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.  
Brown & Sharpe Mfg. Co., Providence, R. I.

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

**SHEARS, Squaring**

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**SHEET METALS**

American Brass Co., 25 Broadway, New York, N. Y.  
Bethlehem Steel Co., Bethlehem, Pa.  
Bridgeport Brass Co., Bridgeport, Conn.  
New Jersey Zinc Co., 160 Front St., New York, N. Y.  
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

**SHEETS, Iron and Steel**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

**SHIMS**

Laminated Shim Co., Inc., Glenbrook, Conn.

**SLEEVES**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Shenango-Penn Mold Co., Dover, Ohio.

**SLOTING MACHINES**

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.

**SOCKETS**

Armstrong Bros., Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**SPECIAL MACHINERY AND TOOLS**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.

(Continued on page 352)

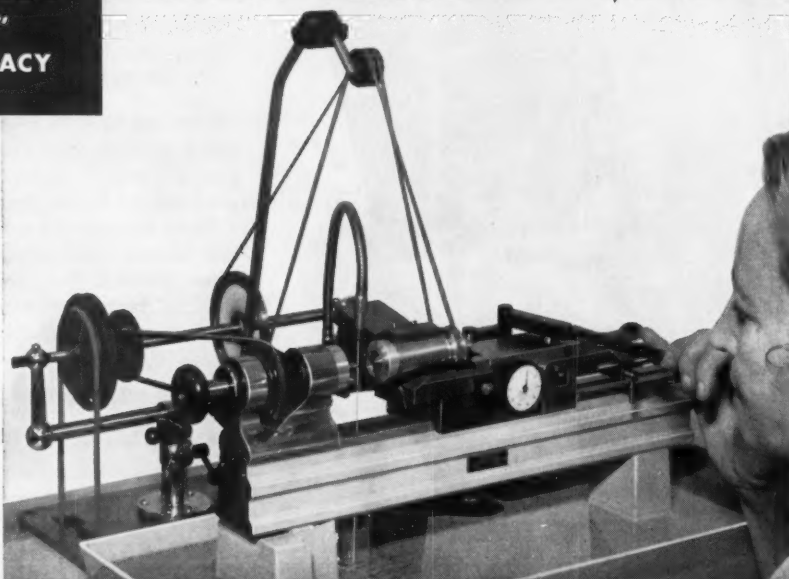
**DRILL  
MICRO-HOLES**

**DOWN TO .0016"  
with SPEED & ACCURACY**

The Levin micro-drilling equipment shown here can be used with the smallest drills available. It is designed so that the drilling does not depend on the operator's sense of feel. The drill can be retracted for chip removal and returned to the drilling position without striking the bottom of the hole. While commercial drills can be had as small as .0016" this micro-drilling apparatus has successfully produced holes as small as .0006".

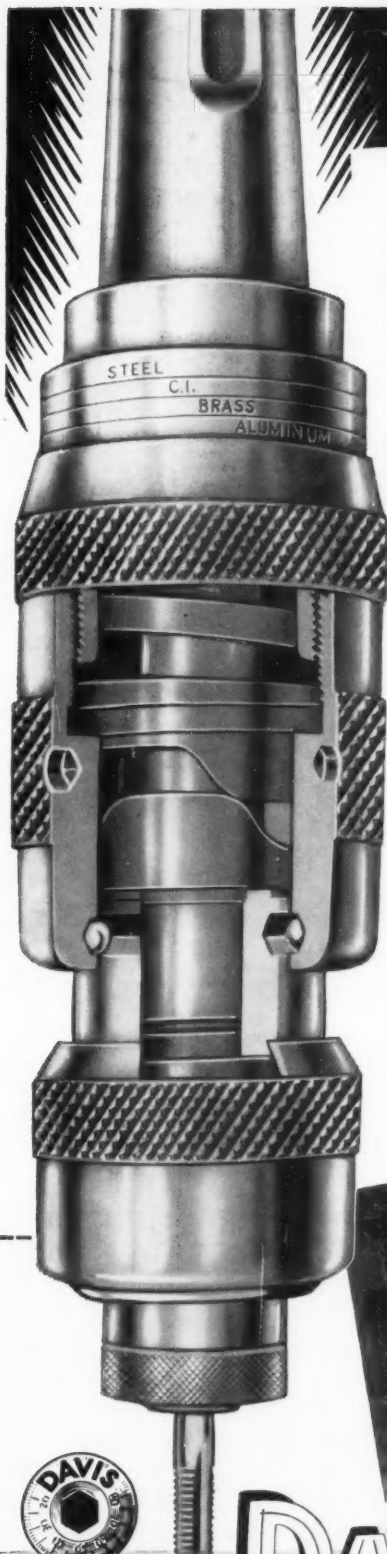
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★ MINIMIZE TAP BREAKAGE! ★ INCREASE TAP LIFE!  
★ GET MORE ACCURATE, BETTER-FINISHED THREADS!

## NEW DAVIS *tap-saver*

*Automatic Torque Control*  
**TAPPING HEAD**

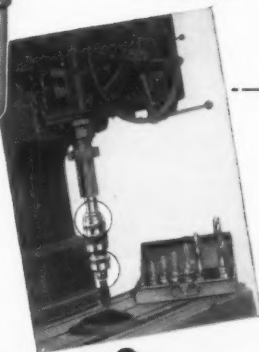
adjusts driving torque to suit  
material, type of tool and  
size of tap

Turn the material selector dial to the proper setting...insert the tool with its proper collet...and your TAP-SAVER tapping head automatically provides exactly the right driving torque for all working conditions!

What's more, this torque is always accurately maintained. Whenever resistance increases, controlled slippage in the overriding clutch within the tapping head compensates for it. Think what this means in terms of operating advantages! Tap breakage is virtually eliminated. Thread accuracy and finish are improved materially. And output rises profitably. Production time is also cut sharply as tools easily interchange in the TAP-SAVER'S quick-change chuck. A series of operations on the same hole can be completed without repositioning either spindle or the work—only the collet and tool are changed.

Investigate now—learn how the new Davis TAP-SAVER can solve many production problems for you and quickly pay for itself in decreased machining costs. WRITE FOR BULLETIN No. DB-160.

### *Machining Advantages*



- ▶ Eliminates "forced," "chattered" and "stripped" threads as well as broken taps—no damage to starting threads when withdrawing tap.
- ▶ TAP-SAVER head does either right or left-hand tapping, drilling, reaming, spot facing and counterboring. Cuts hole time by half.
- ▶ One dial setting covers all work on any material. Absolute safety under all conditions with all tools, in through or blind holes.
- ▶ Three sizes of tapping heads are supplied as standard with Morse taper shanks Nos. 3 through 7. Special shanks or draw key slots for any machine are available on order. Each head furnished in steel box with three drill collets and seven tap collets in appropriate sizes.



# DAVIS

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GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wisconsin

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio.  
 Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
 Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.  
 Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
 Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.  
 Blanchard Mch. Co., 64 State St., Cambridge, Mass.  
 Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.  
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
 Chambersburg Engrg. Co., Chambersburg, Pa.  
 Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
 Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.  
 Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.  
 Consolidated Mch. Tool Corp., Rochester, N. C.  
 Coulter, James, Machine Co., Bridgeport 5, Conn.  
 Cross Co., Detroit, Mich.  
 Erie Foundry Co., Erie, Pa.  
 Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
 Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
 Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
 Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.  
 Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.  
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
 Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Kingsbury Mch. Tool Corp., Keene, N. H.  
 Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
 Mercury Engr. Corp., Milwaukee, Wis.  
 Michigan Drill Head Co., Detroit 34, Mich.  
 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
 Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.  
 Moline Tool Co., 102 20th St., Moline, Ill.  
 Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
 Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.  
 National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
 National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.  
 National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
 National Twist Drill & Tool Co., Rochester, Mich.  
 New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
 New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
 Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
 Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.  
 Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.  
 Universal Engrg. Co., Frankenthuth 2, Mich.  
 Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.  
 Waltham Machine Works, Newton St., Waltham, Mass.  
 Wicaga Machine Corp., Wayne Junction, Philadelphia, Pa.  
 Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

#### SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.  
 Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.  
 Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.  
 Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
 Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.

General Electric Co., Schenectady, N. Y.  
 Harsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.  
 Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
 Philadelphia Gear Works, Inc., Erie Ave. and G. St., Philadelphia, Pa.  
 Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

#### SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

#### SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Pope Mchry. Corp., Haverhill, Mass.  
 Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

#### SPINNING LATHES

See Chucking Machines.

#### SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.  
 Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

#### SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.  
 Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.  
 Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.  
 Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

#### STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.  
 Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

#### STAMPS, Steel and Marking Dies

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

#### STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 National Forge & Ordnance Co., Irvine, Warren County, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.  
 Timken Roller Bearing Co., Canton, Ohio.  
 U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.  
 Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

#### STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Timken Roller Bearing Co., Canton, Ohio.  
 U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.  
 Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

#### STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.  
 Vanadium Alloys Steel Co., Latrobe, Pa.  
 Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

#### STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Timken Roller Bearing Co., Canton, Ohio.

Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

#### STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 Timken Roller Bearing Co., Canton, Ohio.  
 U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.) 436 7th Ave., Pittsburgh, Pa.  
 Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

#### STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

#### STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Carpenter Steel Co., Reading, Pa.  
 Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
 Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.  
 Vanadium Alloys Steel Co., Latrobe, Pa.

#### STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

#### STEEL ALLOYS

See Alloys, Steel

#### STEEL BARS

See Bars, Steel

#### STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Starrett, The L. S. Co., Athol, Mass.

#### STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp., (Alloy), 30 E. 42nd St., New York, N. Y.

#### STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Threadwell Tap & Die Co., Greenfield, Mass.

#### STONES, Oil or Sharpening

Norton Co., 1 New Bond St., Worcester 6, Mass.

#### STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

#### STRAIGHTEDGES

Starrett, The L. S. Co., Athol, Mass.

#### STRAIGHTENERS, Flat Stock and Wire

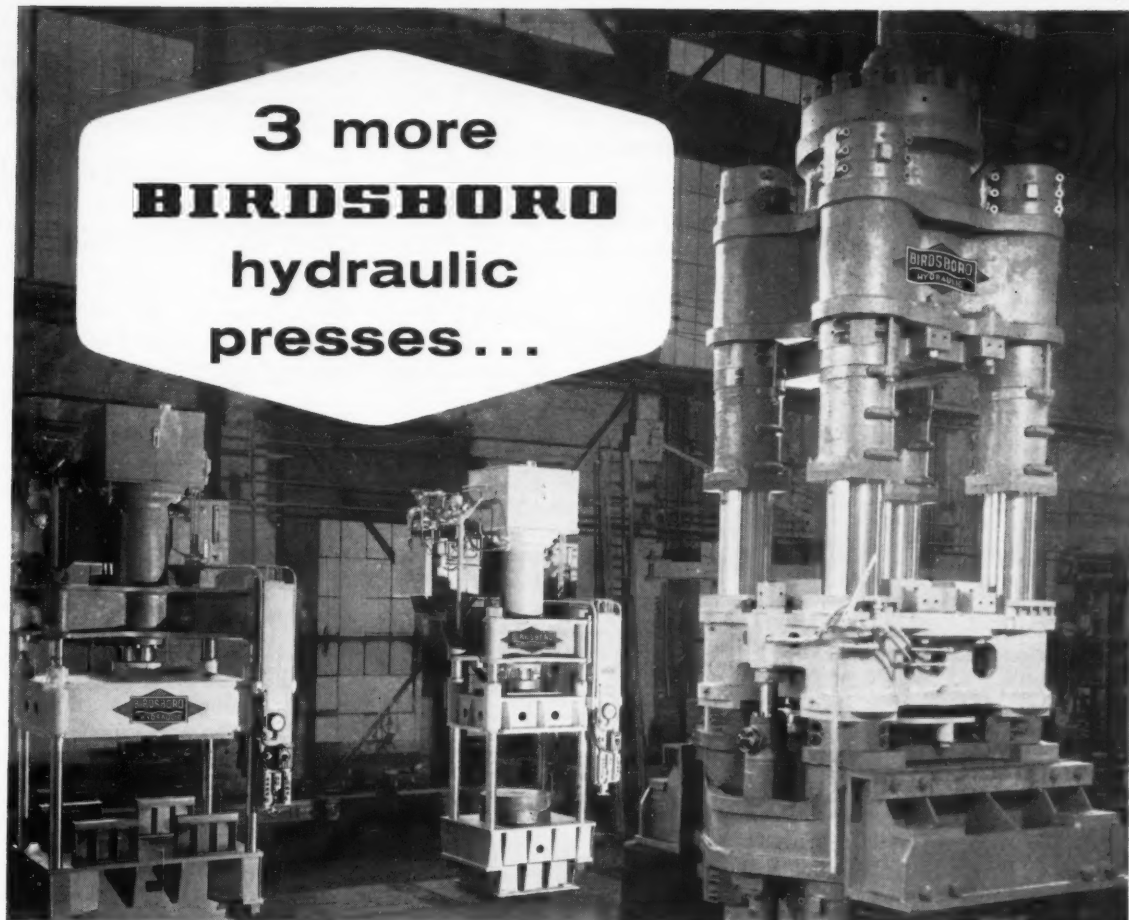
Sesco, Inc., 8881 Central, Detroit 4, Mich.  
 U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

#### STRAIGHTENING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
 Chambersburg Engrg. Co., Chambersburg, Pa.  
 Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.  
 Consolidated Mch. Tool Corp., Rochester, N. Y.  
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
 Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
 Springfield Mch. Tool Co., Springfield, Ohio.

(Continued on page 354)

**3 more  
BIRDSBORO  
hydraulic  
presses...**



**... being delivered to plants where speed  
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OF:**

**STEEL MILL MACHINERY  
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(Metalworking and Extrusion)

**CRUSHING MACHINERY  
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STEEL CASTINGS**

**Weldments "CAST-WELD" Design  
ROLLS: Steel, Alloy Iron, Alloy Steel**

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For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—353



## "Order Me Out a Batch of Gears"



VICE-PRESIDENT, THE CINCINNATI GEAR CO.

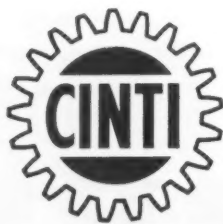
How do you go about buying gears for your products? Get the best price in order to "save" as much money as possible? Well, economy is important, and maybe you can save some money if you consider only the original cost—a few pennies on the price tag of each gear. But how much is this "saving" (if realized) in the *percentage* of the total cost of your product—one or two percent?

Such an amount can disappear in a hurry. A gear is a very critical part in a product; it has a lot to do with the efficiency of the product and the ultimate satisfaction the product gives your customer . . . an importance far beyond its relative size or price. That's why we say the *right* gear is more important than the *cheapest* gear.

Certainly, in competitive times such as these, it is necessary for any manufacturer to reduce costs wherever possible. But when cost-cutting affects product quality or efficiency, watch out. The saving in dollars and cents on a "cut-price" gear is usually pretty small, if there is a saving at all, over buying the gear that is assuredly "right" for the job. And if your specifications indicate possible use of a custom gear, talk to someone from Cincinnati Gear first and let him point out the advantages of custom gearing, and how good gears can be an economy in the long run. You'll find that putting the major emphasis on getting the *right* gear for the job will pay off handsomely.

### THE CINCINNATI GEAR CO. CINCINNATI 27, OHIO

"Gears—Good Gears Only"



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Waltham Machine Works, Newton St., Waltham, Mass.

#### SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

#### SURFACE PLATES

See Plates, Surface

#### SWAGING MACHINES

Behr Machinery & Equipment Corp., 1100 Seminary, Rockford, Ill.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.  
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.

#### SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.  
General Electric Co., Schenectady, N. Y.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

#### TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### TAPER PINS, Standard

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

#### TAP HOLDERS

Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

#### TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.  
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.  
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.  
Michigan Drill Head Co., Detroit 34, Mich.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
Thriffmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

#### TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.  
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.  
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.  
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
Challenge Mchry. Co., Grand Haven, Mich.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Greenlee Bros. & Co., 121th and Columbia Aves., Rockford, Ill.  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.  
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Kaufman Manufacturing Co., Manitowoc, Wis.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

Townsend, H. P. Mfg. Co., Elmwood, Conn.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

#### TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Michigan Drill Head Co., Detroit 34, Mich.

#### TAPS

Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Geometric Tool Co., Westville Station, New Haven 15, Conn.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
Threadwell Tap & Die Co., Greenfield, Mass.  
Winter Bros. Co., Rochester, Mich.

#### TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.  
Landis Mch. Co., Waynesboro, Pa.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

#### THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Coulter, James, Machine Co., Bridgeport 5, Conn.  
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Kaufman Manufacturing Co., Manitowoc, Wis.  
Landis Mch. Co., Waynesboro, Pa.  
Lees-Bradner Co., Cleveland, Ohio.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.  
Besly-Weltes Corp., 112 Dearborn Ave., Beloit, Wis.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Geometric Tool Co., Westville Station, New Haven 15, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Landis Mch. Co., Waynesboro, Pa.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

#### THREAD GAGES

See Gages, Thread

#### THREAD GRINDING MACHINES

See Grinding Machines, Thread

#### THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.  
Lees-Bradner Co., Cleveland, Ohio.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.  
Waltham Machine Works, Newton St., Waltham, Mass.

#### THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.  
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

#### THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa.  
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.



Reed Rolled Thread Die Co., P.O. Box 350,  
Worcester 1, Mass.

### TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.  
U. S. Steel Corp., (Carnegie-Illinois Steel Corp.,  
Div., Columbia Steel Co., Div., Tennessee  
Coal, Iron & R.R. Co., Div.), 436 7th Ave.,  
Pittsburgh, Pa.

### TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Armstrong Bros. Tool Co., 5200 W. Armstrong  
Ave., Chicago, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit,  
Wis.

Carpenter Steel Co., Reading, Pa.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland, Ohio.  
Crucible Steel Co. of America, Oliver Bldg.,  
Pittsburgh 30, Pa.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
du Mont Corp., Greenfield, Mass.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,  
Chicago 18, Ill.

Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.

Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

Vanadium Alloys Steel Co., Latrobe, Pa.

Wheeler-Lovejoy & Co., Inc., Cambridge,  
Mass.

Whitman & Barnes, 40600 Plymouth Rd.,  
Plymouth, Mich.

Williams, J. H. & Co., 400 Vulcan St., Buffalo  
7, N. Y.

### TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland, Ohio.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Haynes Stellite Div., Union Carbide & Carbon  
Corp., 30 E. 42nd St., New York, N. Y.

Kennametal, Inc., Latrobe, Pa.  
Vanadium Alloys Steel Co., Latrobe, Pa.

Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

### TOOL CONTROLS

Royal Design & Manufacturing, Inc., 4133 E.  
Ten Mile Rd., Centerline, Mich.

### TOOL GRINDERS

See Grinding Machines for Sharpening,  
Turning and planing Tools

### TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St.,  
Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong  
Ave., Chicago, Ill.

Burg Tool Mfg. Co., Inc., 15001 S. Figueroa  
St., Gardena, Calif.

Davis Boring Tool Div., Giddings & Lewis Ma-  
chine Tool Co., Fond du Lac, Wis.

Eclipse Counterbore Co., 1600 Bonner Ave.,  
Ferndale, Mich.

Michigan Tool Co., 7171 E. McNichols Rd.,  
Detroit, Mich.

Portage Double Quick Tool Co., 1063 Sweitzer  
Ave., Akron 11, Ohio.

R and L Tools, 1825 Bristol St., Philadelphia  
40, Pa.

Scully-Jones & Co., 1903 Rockwell St., Chicago  
8, Ill. (Turret)

South Bend Lathe Works, Inc., 425 E. Madison  
St., South Bend, Ind.

Warner & Swasey Co., 5701 Carnegie Ave.,  
Cleveland 3, Ohio.

Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

Williams, J. H. & Co., 400 Vulcan St., Buffalo  
7, N. Y.

### TOOLMAKERS' INSTRUMENTS

Ames, B. C. Co., Waltham 54, Mass.

Brown & Sharpe Mfg. Co., Providence, R. I.

Scherr, George, Co., Inc., 200 Lafayette St.,  
New York 12, N. Y.

Starrett, The L. S. Co., Athol, Mass.

### TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Carpenter Steel Co., Reading, Pa.

Crucible Steel Co. of America, Oliver Bldg.,  
Pittsburgh 30, Pa.

Ryerson, Jos. T., & Son, Inc., 2558 16th St.,  
Chicago 18, Ill.

Vanadium Alloys Steel Co., Latrobe, Pa.

### TOOLS, Carbide-Tipped

Ace Drill Corp., Adrian, Michigan.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Besly-Welles Corp., 112 Dearborn Ave., Beloit,  
Wis.

Carboloy Dept., General Electric Co., Box 237,  
Roosevelt Park Annex, Detroit 32, Mich.

Chicago-Latrobe Twist Drill Works, 411 W.  
Ontario St., Chicago, Ill.

Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland, Ohio.

Colonial Broach Co., Detroit 13, Mich.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

Eclipse Counterbore Co., 1600 Bonner Ave.,  
Ferndale, Mich.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit  
32, Mich.

Kennametal, Inc., Latrobe, Pa.

Metal Carbides Corp., Youngstown, Ohio.

National Twist Drill & Tool Co., Rochester,  
Mich.

Spiral Step Tool Co., Chicago 25, Ill.

Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

Whitman & Barnes, 40600 Plymouth Rd.,  
Plymouth, Mich.

### TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Apex Tool & Cutter Co., Inc., 237 Canal St.,  
Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong  
Ave., Chicago, Ill.

Bullard Co., Brewster St., Bridgeport 2, Conn.

Carboloy Dept., General Electric Co., Box  
237, Roosevelt Park Annex, Detroit 32,  
Mich.

du Mont Corp., Greenfield, Mass.

Haynes Stellite Div., Union Carbide & Carbon  
Corp., 30 E. 42nd St., New York, N. Y.

Kennametal, Inc., Latrobe, Pa.

South Bend Lathe Works, Inc., 425 E. Madison  
St., South Bend, Ind.

Warner & Swasey Co., 5701 Carnegie Ave.,  
Cleveland, Ohio.

Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

Williams, J. H. & Co., 400 Vulcan St., Buffalo  
7, N. Y.

### TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Strat-  
ford, Conn.

Barnes Drill Co., 814 Chestnut St., Rockford,  
Ill.

Barnes, W. F. & John, Co., 201 S. Water St.,  
Rockford, Ill.

Buhr Mch. Tool Co., 835 Green St., Ann Arbor,  
Mich.

Colonial Broach & Machine Co., P.O. Box 37,  
Harper Sta., Detroit 13, Mich.

Cross Co., 3240 Bellevue Ave., Detroit 7, Mich.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit  
32, Mich.

Michigan Drill Head Co., Detroit 34, Mich.

Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

### TRANSFORMERS

General Electric Co., Schenectady, N. Y.

### TRANSMISSION, Variable Speed

Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.

Reliance Electric & Engrg. Co., 1047 Ivanhoe  
Rd., Cleveland 10, Ohio.

Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

### TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridge-  
port 5, Conn.

### TUBE FORMING AND WELDING MACHINES

Federal Machine & Welder Co., Overland Ave.,  
Warren, Ohio.

Yoder Co., 550 Walworth Ave., Cleveland,  
Ohio.

### TUBE MILLS

Abbey-Etna Co., 2444 Maplewood Ave., Toledo  
10, Ohio.

Yoder Co., 550 Walworth Ave., Cleveland,  
Ohio.

### TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York,  
N. Y.

Bridgeport Brass Co., Bridgeport, Conn.

Mueller Brass Co., Port Huron 34, Mich.

Revere Copper & Brass Inc., 230 Park Ave.,  
New York, N. Y.

### TUBING, Flexible

American Metal Hose Br. American Brass Co.,  
25 Broadway, New York, N. Y.

### TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Carpenter Steel Co., Reading, Pa.

National Tube Div., U. S. Steel Corp., 525 Wm.  
Penn Place, Pittsburgh, Pa.

Ryerson, Jos. T., & Son, 2558 W. 16th St.,  
Chicago 18, Ill.

Timken Roller Bearing Co., Canton, Ohio.

### TURNING & BORING MACHINES

Hoern & Dilts Div., New Britain Machine Co.,  
Saginaw, Mich.

### TURNING DRILLS

See Drills, Twist

### UNIVERSAL JOINTS

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Boston Gear Works, 3200 Main St., North  
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(Continued on page 356)

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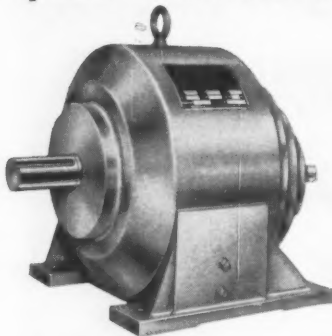
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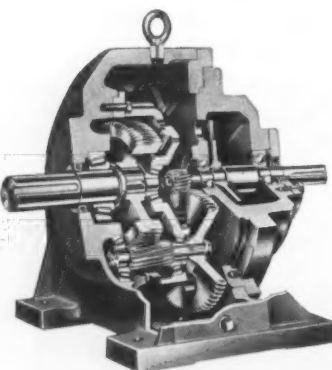
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### VALVE CONTROLS

Philadelphia Gear Works, (Motorized), Erie Ave. and G St., Philadelphia, Pa.  
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

### VALVES, Air

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.  
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

### VALVES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.  
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

### VALVES, Pneumatic

Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

### VIBRATION INSULATION

American Felt Co., Glenville, Conn.

### VICES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Universal Engineering Co., Frankenmuth 2, Mich.  
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

### VICES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### VICES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Shaper Co., Elam and Garrard Ave., Cincinnati, Ohio.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

### VOLTMETERS

General Electric Co., Schenectady, N. Y.

### WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

### WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

### WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

Federal Mch. & Welder Co., Warren, Ohio.  
General Electric Co., Schenectady, N. Y.  
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

### WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Federal Mch. & Welder Co., Warren, Ohio.

### WELDING POSITIONER

du Mont Corp., Greenfield, Mass.

### WELDMENTS

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### WIPERS

Scott Paper Co., Chester, Pa.

### WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.  
Bethlehem Steel Co., Bethlehem, Pa.  
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

### WIRE FORMING MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
U. S. Tool Co., Inc., 255 North 18th St., Amper, N. J.

### WIRE NAIL MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.  
Ryerson, Jos. T. & Son, Inc., 2588 W. 16th St., Chicago 18, Ill.

### WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.  
Mattison Machine Works, Rockford, Ill.

### WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.  
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

### WRENCHES

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg N. J.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Impact

Thor Power Tool Co., Aurora, Illinois

### WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

### WRENCHES, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Tap

Greenfield Tap & Die Corp., Greenfield, Mass.  
Threadwell Tap & Die Co., Greenfield, Mass.

### WRENCHES, Torque Measuring

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
LaSalle Tool, Inc., Detroit, Michigan  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### ZINC

New Jersey Zinc Co., 160 Front St., New York, N. Y.

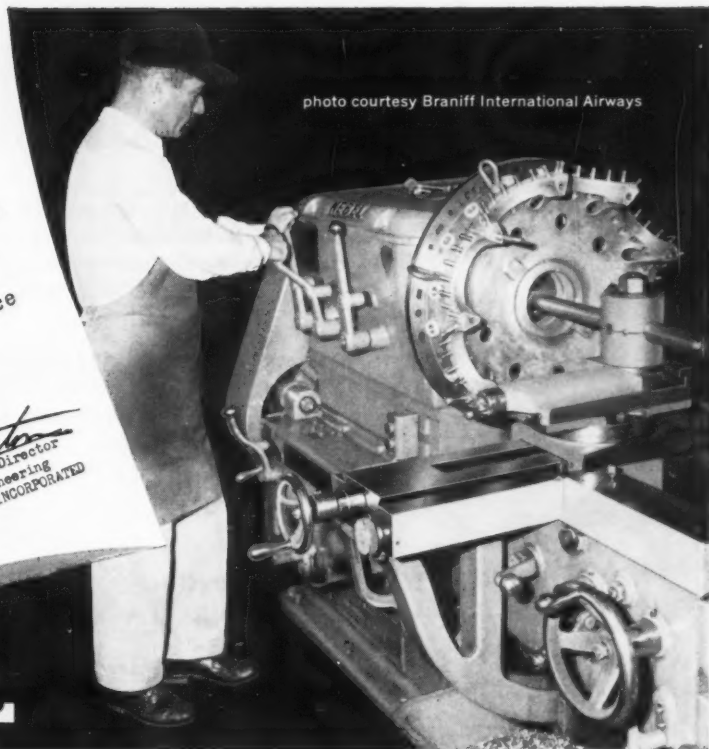
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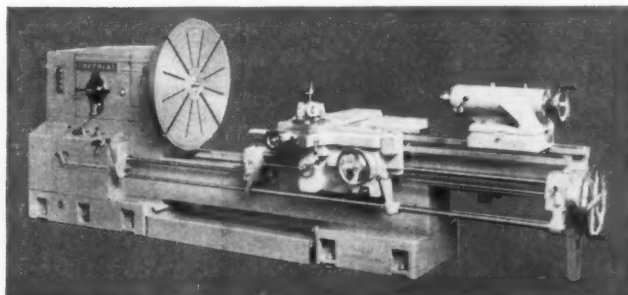
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AG series 20"/40"	22 1/2"	40"	24"	6 ft.	20 ft.	9-280 or 16-500	7 1/2-10
G series 28"/50"	29"	52"	41"	10 ft.	30 ft.	5-230 or 10-460	20-25

\*on shortest bed length

†increasing in increments of 2 ft.

For more information fill in page number on Inquiry Card, on page 261

MACHINERY, July, 1956—357

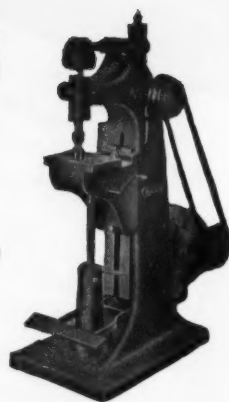


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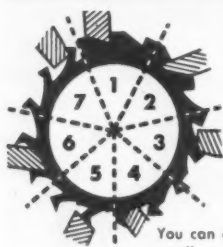
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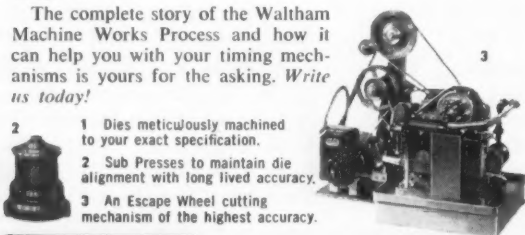


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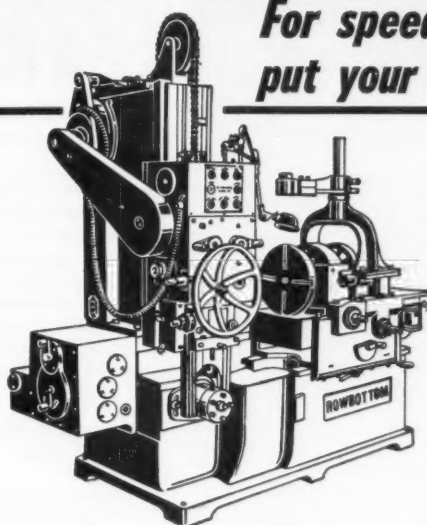
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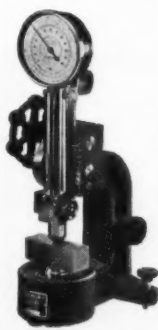
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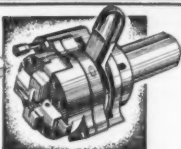
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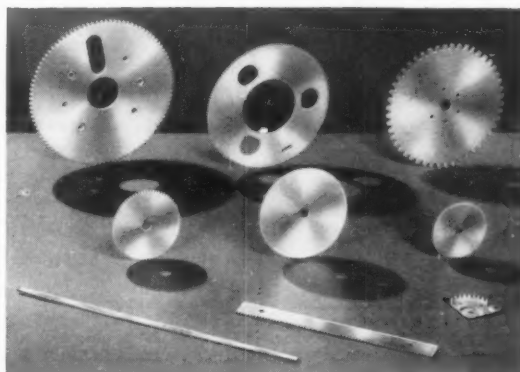
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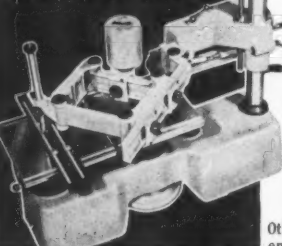


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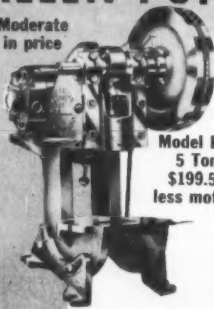
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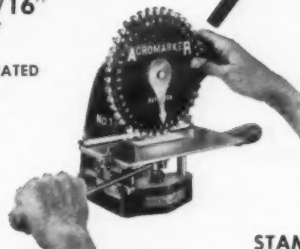
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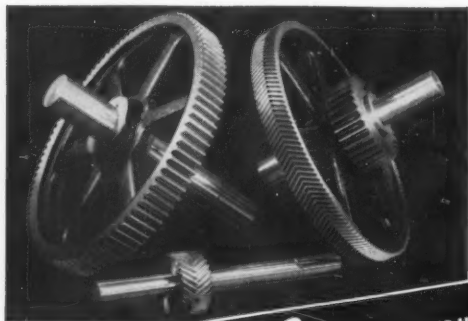
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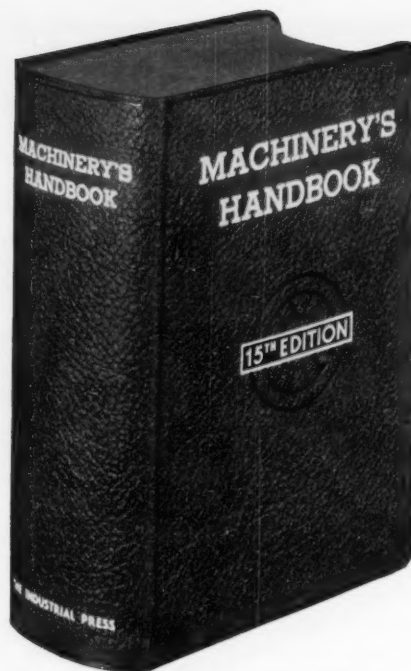
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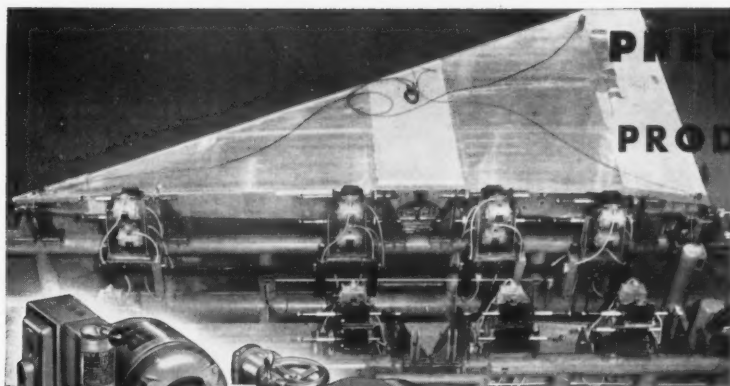
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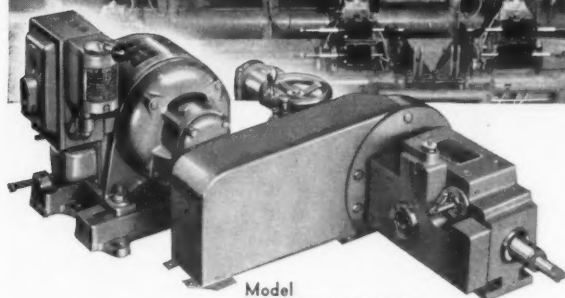
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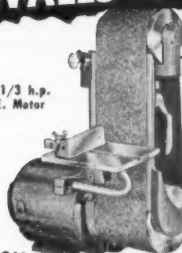
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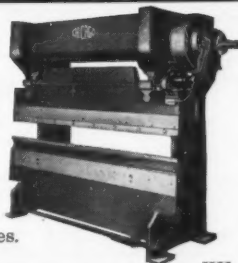
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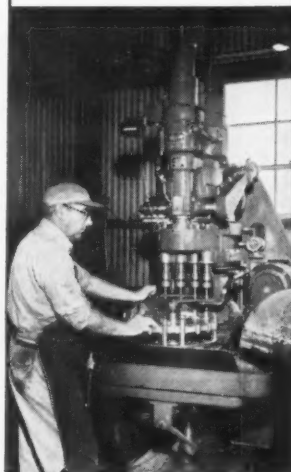
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The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS

#### RAILROAD MACHINERY

No. 2 Niles-Bement-Pond Axle Lathe, m.d.  
No. 3 Niles-Bement-Pond Axle Lathe, m.d.  
52" Betts Car Wheel Borer  
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest  
90" Putnam Driving Wheel Lathe, m.d.  
90" Niles Journal Lathe, including 2 inside Journal Turrets and 3 1/2" spindle double quartering attachment, m.d.  
90" Niles Driving Wheel Lathe, m.d., latest  
No. 3 Betts Bridgeford Axle Lathe, m.d.  
Betts Bridgeford Combination Journal Truing & Axle Lathe, 3 carriages, new

#### SHAPERS

No. 14 Cochran Bly Vertical Shaper, m.d.  
16" Gould & Eberhardt Shaper, m.d.  
24" Hendey Back Geared Crank Shaper, m.d.  
24" Potter & Johnston, cone  
32" Morton Draw-Cut, m.d., late  
32" Ohio Shaper, m.d.  
32" Cincinnati, m.d., late  
32" Columbia H.D. Plain Back Geared Crank Shaper, m.d.  
36" Morton Draw-Cut, m.d., late  
36" Rockford Universal Openside Shaper Planer, m.d.  
38" Morton Draw-Cut Shaper

#### TAPPERS

No. 1 Bakewell, m.d., late  
No. 1 Haskins, pneumatic control, type 1 CAP  
No. 2 Haskins, pneumatic control, type 2 CAP  
No. 3 Haskins, pneumatic control, type 3 CAP  
Acme Semi-Automatic 6 spindle, 1 1/2", arranged for m.d.  
No. 3C Haskins, pneumatic control, type 3 CAM, m.d.  
2 spindle Haskins, pneumatic control, m.d.  
No. 22 Murchey, 6 to 28 pitch  
3 way Natcho Tapper & Drill

#### SHEET METAL MACHINERY

No. 2 Libert Nibbler, 28" throat  
No. 3—5/8" capacity Gray Sheet Metal Cutter, m.d.  
12"x6" cap. Davis & Krump Leaf Brake, m.d.  
Size 848 Model O Parker Tube Bender, hand operated  
No. 6 Niles Pyramid Type Plate Bending Mill, 12"x5/8", m.d.  
No. 11-SBC Buffalo Armor Plate Bar Cutter, m.d.  
No. 47 Buffalo Double End Shear and Bar Cutter, m.d.  
Model 1236 Libert High Speed Nibbler Type Shear, m.d.  
Brand New Webb Model BB-6 Pyramid Type Plate Bending Roll  
Gray Turret Head Metal Cutter, m.d.  
No. 3 Byerson Rotary Bevel Shear  
#6 1/2 Hilles & Jones Gate Shear

#### TURRET LATHES AND SCREW MACHINES

No. 601 W. D. Oster Geared Head Rapiduction, m.d., chucking  
No. 1 Warner & Swasey "Electric", m.d., bar  
No. 1A Warner & Swasey, m.d., 1940  
No. 1L Gisholt Universal, m.d., 1943

No. 1, 2 Cincinnati Acme Full Universal, m.d.  
No. 1-H-5 Libby, m.d.  
No. 2A Warner & Swasey, m.d., preselector head, late  
No. 2F Foster Fastermatic, m.d., Timken  
No. 2L Gisholt Universal, m.d., latest type, 1945  
No. 3 Cincinnati Acme Full Universal, m.d., chucking  
No. 3 Foster Geared Head, m.d.  
No. 3 Bardons & Oliver Universal Ram Type, m.d.  
No. 3 Jones & Lamson, m.d., 1943  
No. 3A Warner & Swasey, m.d., 1942  
No. 3F Foster Fastermatic, m.d., Timken  
No. 4 Warner & Swasey, cone, bar and chucking types  
No. 4A Warner & Swasey, Universal, m.d., chucking, 1939  
No. 4 Gisholt Universal, m.d.  
No. 4L Gisholt Universal, m.d., 1943  
No. 4FU Foster Fastermatic, m.d., latest, 1945  
No. 5 Gisholt Ram Type, preselector head, m.d.  
No. 5 Gisholt Universal, m.d., late type, 1942  
No. 7A Jones & Lamson Universal  
5 1/2" Pratt & Whitney Hand Screw Machine, cone, bar  
2 1/2"x24", 3 1/2"x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking  
18" Libby Type A, m.d., chucking  
20" Acme, s.p.d., bar  
20" Drees, arranged for factory m.d.  
26" Libby Type C, m.d., chucking

#### MISCELLANEOUS

Model 20074 Loganport Arbor Press  
2" Acme All Steel Heading, Upsetting & Forging Machine, m.d.  
Sciaky Type PMCO-28-31 Storage of Energy Spot Welder, 50 KW, 34" throat  
Federal Machine Co. Becker Arm Spot Welder, 1440 KVA-MFD, 220 volts  
No. 70 Cross Deburring Machine, m.d., 1940  
Pratt & Whitney Standard Measuring Machine, 36" capacity  
Type 114CB Moline Tool Boring Machine, two spindle type, m.d.  
No. 118 Cochran Bly Saw Sharpening Machine, belted m.d.  
Brinnell Hardness Tester  
Wagner Saw Sharpener, m.d.  
No. 11 Cochran Bly Saw Sharpener, belt drive  
Logan Hydraulic Vertical Shaper, m.d., 12" stroke  
Detroit Model A Power Screw Driving Machine, m.d.  
Gorton Model AE Engraver, hand feed type  
#1 Fischer Oil Groover, m.d., 1942  
Gogan Hardness Tester, model 1618, 1942  
Gisholt Precision Balancing Machine, m.d.  
Lerol Electric Power Plant  
No. 2 Cochran Bly Filing Machine, pedestal type  
Hanchett Grinding Head, Vertical type for mounting on planer, rail  
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GRINDERS, CYLINDRICAL, 10" x 18" Norton semi-automatic, plunge cut, new 1943.  
GRINDERS, SURFACE, 13" x 60" Model 300 Hanchett vertical spindle, new about 1946.  
AUTOMATIC, 1 1/2" x 6 spindle No. 61 New Britain chucker, serial 25230  
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.  
SURFACE GRINDER, No. 1 1/2 Abrasive, serial 786, late.  
MILL, No. 2 Cincinnati plain horizontal, serial 442PK17, late.  
LATHE, 28" x 20" bed Lodge & Shipley engine lathe, 20 HP Drive unit.  
MILL, No. 34-36 Cincinnati duplex mill, serial 3330H-4, late.  
GRINDER, 4" x 12" Model 4H Landis plain cylindrical, new 1943.  
LATHES, ENGINE, 14" x 6" bed Hendey toolroom, Timken, 1940.  
LATHES, MFG., Model 10 Sundstrand automatic, front & rear slides, new 1942.  
LATHES, TURRET, No. 3 Gisholt universal (2) late.  
LATHES, TURRET, 36" and 42" Bullard New Era vertical.  
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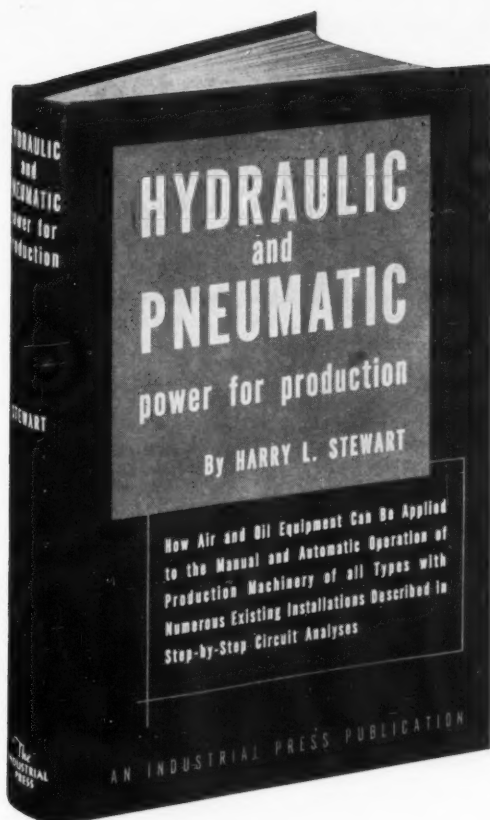
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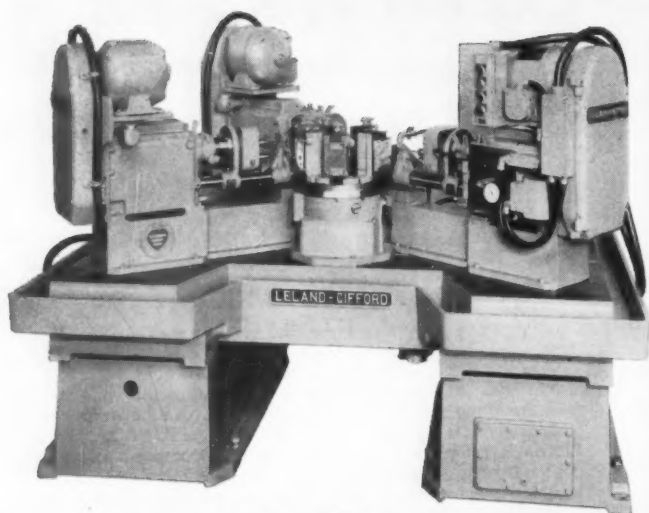
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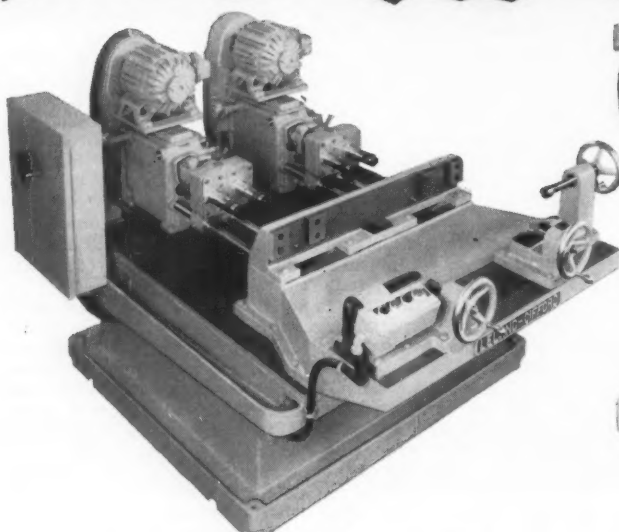
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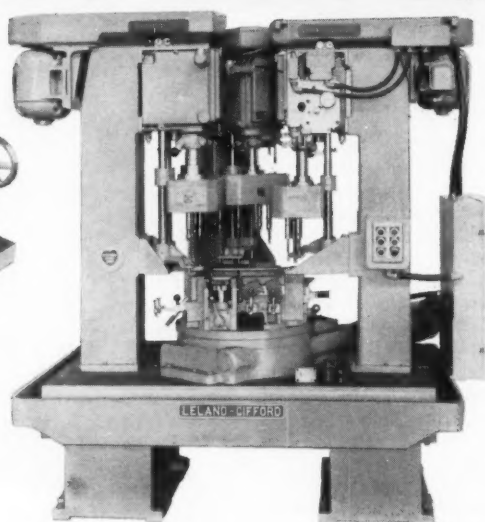
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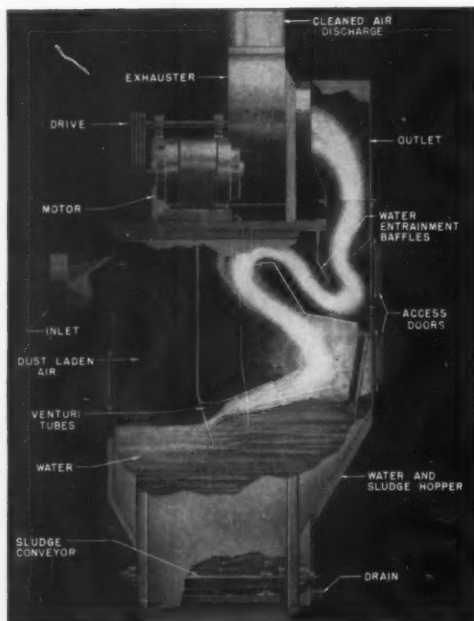
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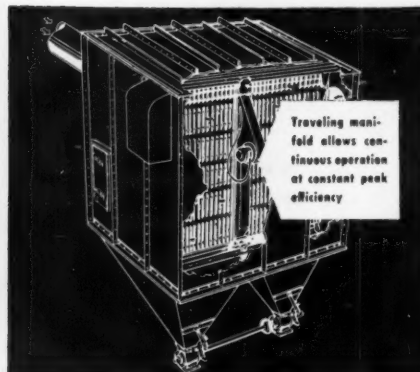
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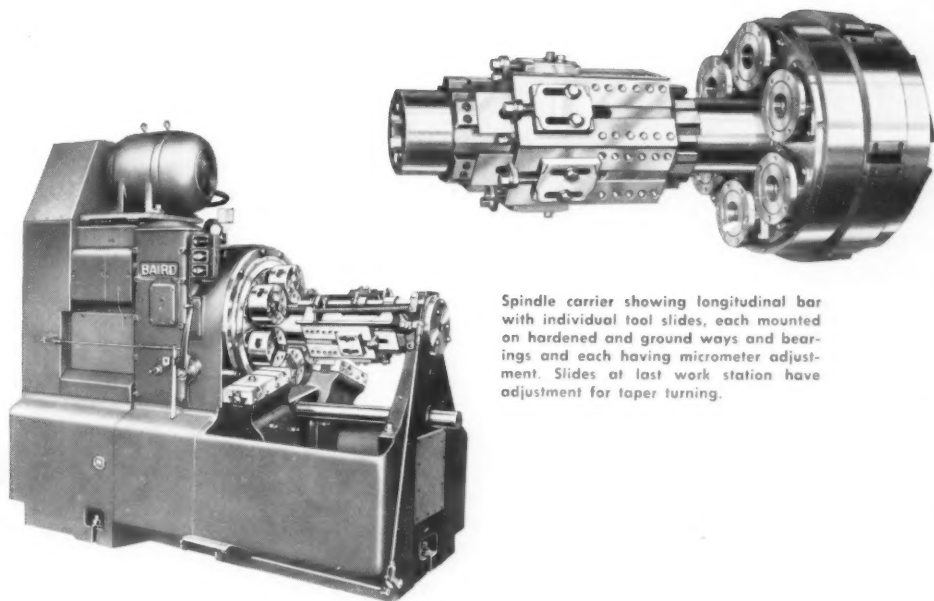
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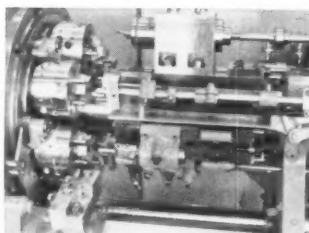
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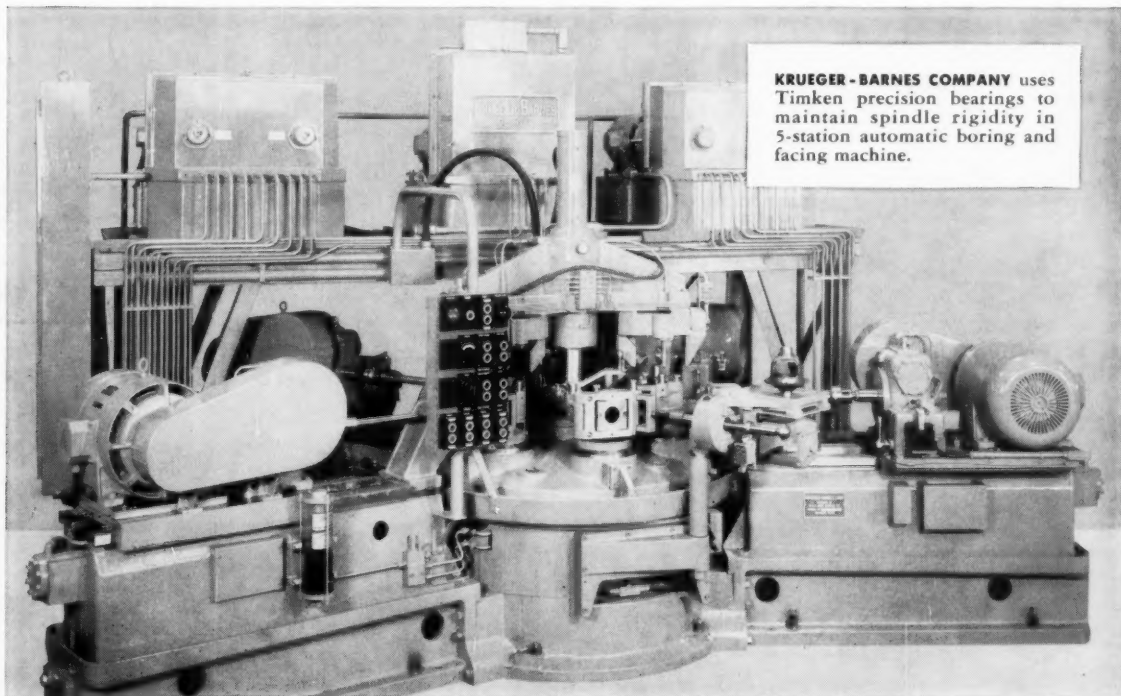
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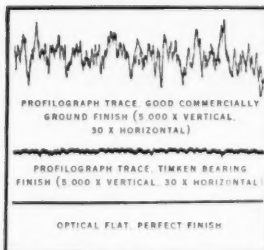
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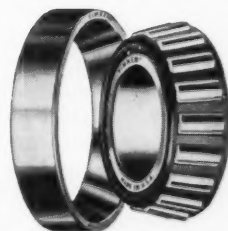
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